

77 Rec'd PCT/PTO 05 MAY 1998

FORM PTO-1390 (Modified)  
(REV 10-95)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

## TRANSMITTAL LETTER TO THE UNITED STATES

(ROS) S11-PC/PC1/US

09/068278

DESIGNATED/ELECTED OFFICE (DO/EO/US)

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 1.5)

CONCERNING A FILING UNDER 35 U.S.C. 371

INTERNATIONAL APPLICATION NO.

PCT/EP97/05216

INTERNATIONAL FILING DATE

September 23, 1997

PRIORITY DATE CLAIMED

09/23/96; 11/04/96

TITLE OF INVENTION

Continuous Cable Processing Device

APPLICANT(S) FOR DO/EO/US

Beat Locher and Jiri Stepan

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
  - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☒ has been transmitted by the International Bureau.
  - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ A copy of the International Search Report (PCT/ISA/210).
8. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
  - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
  - b. ☐ have been transmitted by the International Bureau.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
  - d. ☐ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

## Items 13 to 18 below concern document(s) or information included:

13. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.  
A **SECOND** or **SUBSEQUENT** preliminary amendment.
16. ☐ A substitute specification.
17. ☐ A change of power of attorney and/or address letter.
18. ☒ Certificate of Mailing by Express Mail
19. ☒ Other items or information:

Copy of Form PCT/IB308

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 1.5)	INTERNATIONAL APPLICATION NO. <b>PCT/EP97/05216</b>	ATTORNEY'S DOCKET NUMBER <b>(ROS) S11-PC/PC1/US</b>
---	--	--

20. The following fees are submitted:

**BASIC NATIONAL FEE ( 37 CFR 1.492 (a) (1) - (5) ) :**

- |  |                   |
|--|-------------------|
| <input checked="" type="checkbox"/> Search Report has been prepared by the EPO or JPO .....  | <b>\$930.00</b>   |
| <input type="checkbox"/> International preliminary examination fee paid to USPTO (37 CFR 1.482) .....  | <b>\$720.00</b>   |
| <input type="checkbox"/> No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) ..... | <b>\$790.00</b>   |
| <input type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO .....          | <b>\$1,070.00</b> |
| <input type="checkbox"/> International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) .....       | <b>\$98.00</b>    |

**ENTER APPROPRIATE BASIC FEE AMOUNT =**

**CALCULATIONS PTO USE ONLY**

Surcharge of **\$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	48 - 20 =	28	x \$22.00		<b>\$616.00</b>
Independent claims	8 - 3 =	5	x \$82.00		<b>\$410.00</b>

Multiple Dependent Claims (check if applicable). ☐

**TOTAL OF ABOVE CALCULATIONS = \$1,956.00**

Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) (check if applicable). ☐

**SUBTOTAL = \$1,956.00**

Processing fee of **\$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).

**TOTAL NATIONAL FEE = \$1,956.00**

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable). ☐

**TOTAL FEES ENCLOSED = \$1,956.00**

Amount to be refunded	\$
charged	\$

- ☐ A check in the amount of \_\_\_\_\_ to cover the above fees is enclosed.
- ☒ Please charge my Deposit Account No. **11-0665** in the amount of **\$1,956.00** to cover the above fees.  
A duplicate copy of this sheet is enclosed.
- ☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **11-0665** A duplicate copy of this sheet is enclosed.

**NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.**

SEND ALL CORRESPONDENCE TO:

**M. Robert Kestenbaum**  
**11011 Bermuda Dunes NE**  
**Albuquerque, New Mexico 87111**  
**Phone (505) 323-0771**  
**Fax (505) 323-0865**



SIGNATURE

**M. Robert Kestenbaum**

NAME

**20,430**

REGISTRATION NUMBER

**May 5, 1998**

DATE

**VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY  
STATUS (37 CFR 1.9(f) AND 1.27 (c)) - SMALL BUSINESS CONCERN**

Docket No.  
(ROS) S11-PC/PC1

Serial No.  
09/068,278

Filing Date  
May 5, 1998

Patent No.

Issue Date

Applicant/  
Patentee: **Locher et al**

Invention: **Continuous Cable Processing Device**

I hereby declare that I am:

- ☐ the owner of the small business concern identified below:  
☒ an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF CONCERN: Schleuniger Holding AG

ADDRESS OF CONCERN: Glutz-Blotzheim-Strasse 3, CH-4502 Solothurn, Switzerland

I hereby declare that the above-identified small business concern qualifies as a small business concern as defined in 37 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under Section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the above identified invention described in:

- ☐ the specification filed herewith with title as listed above.  
☒ the application identified above.  
☐ the patent identified above.

If the rights held by the above-identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed on the next page and no rights to the invention are held by any person, other than the inventor, who could not qualify as an independent inventor under 37 CFR 1.9(c) or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- ☐ no such person, concern or organization exists.  
☐ each such person, concern or organization is listed below.

FULL NAME Schleuniger, Inc.  
 ADDRESS 87 Coloin Drive USA-Manchester, NH 03103  
☐ Individual ☒ Small Business Concern ☐ Nonprofit Organization

FULL NAME Schleuniger AG  
 ADDRESS Bierigutstrasse 9 CH-3608 Thun  
☐ Individual ☒ Small Business Concern ☐ Nonprofit Organization

FULL NAME Schleuniger Japan Co. Ltd.  
 ADDRESS Grand Palace Tamachi 1F Shibaura 4-9-18, Minato-ku JP-Tokyo 108  
☐ Individual ☒ Small Business Concern ☐ Nonprofit Organization

FULL NAME \_\_\_\_\_  
 ADDRESS \_\_\_\_\_  
☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING: Dr. Gerhard Jansen  
 TITLE OF PERSON SIGNING Geschäftsführer (business director)  
 OTHER THAN OWNER: \_\_\_\_\_  
 ADDRESS OF PERSON SIGNING: Glutz-Blotzheim-Strasse 3  
CH-4502 Solothurn  
Switzerland

SIGNATURE:


DATE: Mai 18 1998

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Re: Application Serial Number: PCT/EP97/05216  
International Filing Date: September 23, 1997  
Applicants: Locher et al  
Attorney Docket: (ROS) S11-PC/PC1/US

Box PCT  
Assistant Commissioner for Patents  
Washington, D.C. 20231

Preliminary Amendment

Please amend the above-identified application as follows:

In the Specification:

Page 4, following line 7, insert --

Also known is a "Komax 153 insulation stripping station" which has, arranged side by side, pairs of insulation stripping knives which can be moved in a carriage in the radial direction - with respect to the cable. However, this known insulation stripping station processes cable ends in a procedure in which cables cannot be processed continuously or linearly. Owing to the design of the known structure, no space is available for transporting the cable onward. It is therefore not obvious to combine such a known structure with a conventional continuous cable-processing machine (processing linearly with a front and a rear drive - e.g. rollers). This known apparatus furthermore does not permit reception of any desired tool. Moreover, the movements of the knives are restricted to opening and closing.--.

Page 5, following line 12, insert -- US A4,584,912 and US A5,526,718 also describe a wire cutting and stripping apparatus and process, which is not relevant to the applicant's invention.--.

In the Claims:

Cancel Claims 1 - 38 and insert the attached new Claims  
39 - 87.

Remarks

Please determine the prescribed filing fee on the basis of this Preliminary Amendment.

Respectfully Submitted,



M. Robert Kestenbaum  
Reg. No. 20,430  
11011 Bermuda Dunes NE  
Albuquerque, New Mexico 87111  
Phone (505) 323-0771  
Fax (505) 323-0865

2025-02-23 10:23:23

Patent claims

39. A cable insulation stripping apparatus, comprising:

a pair of tool supports (1, 2) for holding at least two tools (3) in pairs, and

a tool support feed means (5) for lateral positioning of at least one of said tools (3a, b, c, d) above a first transport path (100) along which a cable (107) whose insulation is to be stripped can be inserted in its feed direction, wherein

said tool support feed means (5) is formed for a controlled lateral drive for controlled sideward movement of at least one tool support (1, 2) to any desired position within a working range laterally with respect to said transport path (100).

40. The apparatus as claimed in claim 39, wherein a separate tool support feed means (5a, b) is coordinated with each tool support (1, 2) so that upper and lower positions of said tools (3) can be combined.

41. The apparatus as claimed in claim 39, wherein said tool supports (1b, 2b; 1c, 2c) are held on a common support part (8) and can be displaced together with said common support part (8).

42. The apparatus as claimed in claim 39, wherein said tool supports (1, 2) have, in a lateral direction, a plurality of optionally continually positionable holders for said tools (3), said tools (3) being selectable as required from a group of cable-processing tools.

43. The apparatus according to claim 42, wherein said group of cable-processing tools consists of crimping tools, twisting tools, punching tools, clamping tools, marking apparatuses and grinding means.

44. The apparatus as claimed in claim 39, wherein said tool supports (1, 2) are continuously adjustable relative to one another or toward and away from said transport path (100), optionally independently of one another.

45. The apparatus as claimed in claim 39, wherein said tools (3) are arranged in pairs and comprise at least two pairs of knives.

46. The apparatus as claimed in claim 45, wherein one of said pair of knives is above said cable and another of said pair of knives is under said cable.

47. The apparatus as claimed in claim 39, wherein said tool support feed means (5) comprises at least one motor and a programmable microprocessor for control of said motor.

48. The apparatus as claimed in claim 47, wherein said tool support feed means (5) comprises a cable absence sensor.

49. The apparatus as claimed in claim 47, wherein a plurality of tool support feed means (5) holding a plurality of tool supports (1, 2) are arranged along said first transport path (100).

50. A cable processing apparatus, comprising:

a pair of tool supports (1, 2) for holding at least two tools (3) in pairs, and

a tool support feeds means (5) for lateral positioning of at least one of said tools (3a, b, c, d) above a first transport path (100), along which a cable (107) whose insulation is to be stripped can be inserted in its feed direction, wherein

an encoder (41) is arranged on an adjusting spindle (14) for tool setting and monitors rotary movement of said adjusting spindle (14) in an operating state as a function of drive movement of a drive (23; 16), optionally by comparison with a comparable encoder value of said drive (23; 16) on said encoder in order to perform at least one of the following: to detect completed closure of said tools (3), to stop said drive movement, to calibrate and to initialize said drive or said encoder.

51. A cable processing apparatus according to claim 50, wherein connection between said drive (23; 16) and said spindle (14) is elastic, optionally a coupling via a toothed belt (24).

52. A process for operating a cable processing apparatus having tool holders and insertable tools, comprising:

employing a monitor that monitors an open state of said tool holders (1) or tools (3) and reduces a drive force of a drive motor (23; 16) shortly before closing said tool holders or tools, so that said drive motor brings said tool holders into a closed position with slight force, and

optionally detecting said closed position of said tool holders by virtue of an encoder connected to or integrated

with said drive motor (23; 16) that loses its steps of rotary movement notwithstanding a supply of drive energy, or that said drive motor (23; 16) comes to a stop notwithstanding a supply of drive energy.

53. A cable processing apparatus having rollers or continuous belts for longitudinal transport of a cable along a transport path (100), wherein said rollers (A, B; 111) or continuous belts (C; 112) are located opposite one another across said transport path (100) and are adjustable relative to one another and can be opened and closed in a cable-dependent and feed-controlled manner.

54. A cable processing apparatus as claimed in claim 53, wherein a cable is received between opened rollers (A, B; 111) or belts (C; 112) and is transported onward by means of rollers (111) or belts (112) that are moved toward one another and held against one another under a contact pressure.

55. A cable processing apparatus as claimed in claim 53, wherein said rollers (111) or belts (112) belonging to two pairs of rollers or belts (A, B; 111; C; 112), are adjustable relative to one another by means of at least one of stepping motors, a control having an automatic RESET, a programmable circuit, and at least one pressure sensor for measuring or evaluating contact pressure on said cable (107) that is coordinated with motors.

56. A cable apparatus as claimed in claim 53, further comprising a control member having a computer which, in an

operating state, after input of cable diameter, and optionally, cable type designation, and desired insulation stripping length, automatically calculates and sets at least one of an initial opening of said roller or belt drive (A, B; 111; C; 112) and a contact pressure for stripping of long insulation sections, and appropriately controls said drives.

57. A cable processing apparatus having drive and processing stations, wherein a common baseplate is provided, on which at least one of drive, feed, tool holders, and measuring or marking modules can be provided in a mountable manner at predetermined positions along a cable transport path.

58. The apparatus as claimed in claim 57, wherein at least one of pairs of continuous belts (112) or rollers (111) of said feed module can be removed without replacement or can be replaced by coated drive rollers (111) or pairs of continuous belts (112), or a continuous belt pair module (C) can be replaced by roller modules (A, B), and vice versa.

59. A cable processing apparatus having drive and processing stations, with at least one movable guide (40) associated with a processing station (3), wherein said guide (40) is connected to a control that alternatively moves said guide completely from a cable transport path (100) during a cable processing mode.

60. The apparatus as claimed in claim 59, wherein at least one guide (40) is arranged on that side of said processing station which faces a cable outlet.

61. The apparatus as claimed in claim 59, wherein said guide (40) can be raised in a radial plane relative to said cable transport path.

62. The apparatus as claimed in claim 59, wherein one guide (40) each, and at least one drive station (C) each, are arranged in front of and behind said processing station (3), and said drive stations (C) are arranged symmetrically with respect to said processing station (3).

63. A process for controlling a cable insulation stripping apparatus, comprising:

employing a program that contains a control for controllable driving of said apparatus, said program comprising program steps coordinated with individual process steps,

combining a plurality of such program steps to form groups of operations, in which a step sequence is predetermined and control parameters of at least one step are selectable or adjustable, and

calling up groups of operations to trigger a plurality of program steps that are preprogrammed in such a manner and result in control of drives in step sequence.

64. The process as claimed in claim 63, wherein at least one of an individual program, process steps and control parameters linked therewith can be set to at least one of 0 and desired other parameters via an input unit.

65. The process as claimed in claim 63, wherein a plurality of program groups are combined to form overlapping program

groups, and wherein individual program groups are shown as an overview and subsequently in detail on a display, said display permitting interactive correction of given values in individual program steps.

66. A continuous cable processing apparatus, comprising:

a cable transport apparatus, which comprises at least one first and at least one second transport means (A, B; C; 111, 112, 113) for linear transport and holding of a cable (107) along a first transport path definable by a cable axis (106),

at least one knife station (E, F, G, 115) for processing said cable (107) along said transport path (100), said knife station (E, F, G, 115) being arranged between two transport means (A, B; C, 111, 112, 113) and, before and after processing of said cable (107), said transport means holding at least one of said cable and one each of cable end regions (107a, b) facing one another and created by said knife station, parallel to said first transport path (100) and so as to be movable in a cable longitudinal direction, wherein at least one of said knife station (E, F, G, 115) and said transport means (A, B; C, 111, 112, 113) is displaceable approximately at right angles or at right angles to said first transport path (100) by means of a motor.

67. The cable processing apparatus as claimed in claim 66, wherein displaceability of one or more transport means (A, B; 112, C, 113) permits parallel displacement of at least of

one of said cable (107) and at least one cable end (107a, b) from said first transport path (100) to at least a second transport path (102, 103), and wherein a further processing station (16, 17) can be coordinated with said second transport path (102, 103).

68. The apparatus as claimed in claim 67, wherein said further processing station comprises at least one transport or processing station (16, 17), selected from the group consisting of an insulation stripping station, a sawing station, a cutting station, a twisting station, a shaping station, a crimping station, a soldering station, a cable processing station and a manipulator arm.

69. The apparatus as claimed in claim 67, wherein at least one transport means (A, B; 111; C, 112, 113), is guided in a linear guide (110) transversely to said transport path (100) and can be moved by a drive apparatus (111 - 114).

70. The apparatus as claimed in claim 69, wherein said transport means is located one each on both sides of said knife station (E, F, G, 115).

71. The apparatus as claimed in claim 67, wherein a drive apparatus (111 - 114) of each movable transport means (111, 112, 113) and at least one independent transport drive, is connected to a common control, and at least one further processing station (16, 17), so that all longitudinal and transverse movements can be performed in a coordinated and time-optimized manner, in synchronization with the processing steps.

72. The apparatus as claimed in claim 71, wherein said transport drive is located one each on both sides of said knife station (E, F, G, 115) and said common control also controls said knife station (E, F, G, 115).

73. The apparatus as claimed in claim 67, wherein two transport means (112) are connected to one another by a common motor-controlled actuator (101) so that, transverse adjustment of one transport means (112a) inevitably results in a diametrically opposite lateral adjustment of the other transport means (112b).

74. The apparatus as claimed in claim 67, wherein at least one transport means (112a) is connected to at least one of said knife station (115) and tool support by a common, motor-controlled actuator (104) so that transverse adjustment of one transport means (112b) inevitably results in a diametrically opposite transverse adjustment of at least one of said knife station (115) and said tool support.

75. The apparatus as claimed in claim 39, wherein a processing station comprises at least one of a rotatable knife, and a second knife station having a rotatable knife (030), whose axis of rotation is along at least one transport path is provided in addition to a knife station.

76. A process for stripping insulation of a cable (107) by means of an apparatus as claimed in claim 75, comprising:

holding a cable (107) in a centered manner on at least two sides, during incision with the knife (030),

arranging at least one holding point in immediate vicinity of said knife (030),

at least one of coupling a knife feed with at least one feed for clamping and centering apparatus and separating said clamping feed from said knife feed, and

at least one of holding at least one of at least one transport means and centering apparatus nonrotationally and rotating said centering apparatus (111; 112) closest to said knife together with said knife.

77. The apparatus as claimed in claim 75, wherein at least one of said clamping and centering apparatus (A, B; 111, C, 112; 013) comprises at least two clamping or centering jaws (111; 112; 013) which lie in a plane, each have a retaining surface, which retaining surfaces are at least approximately perpendicular to a radial plane with the cable (107) and are formed in such a way that closing of said jaws (A, B; 111; C, 112; 013) to approximately zero cable diameter is possible.

78. The insulation stripping apparatus as claimed in claim 77, wherein a cutting apparatus comprises at least two knife jaws (030) which lie in a plane, each having a cutting edge, which cutting edges are formed at least approximately parallel to one tangential plane each of a cable (107) and can be closed to zero and can be advanced to give different initial contact points at an edge with a cable sheath, depending on cable diameter.

79. The apparatus as claimed in claim 47, wherein said knife station, and at least one centering clamping apparatus (A, B; 111, C; 112, 013) are in a form of an automatic processing module (057) which is removably mounted on a continuous cable processing machine (058).

80. The apparatus as claimed in claim 79, wherein said module (057) is connected to a frame of said continuous cable processing machine (058) by a hinge (059) so that said machine can be swiveled out of an axial working position, relative to said cable (107), into a mounting position inclined relative thereto.

81. The apparatus as claimed in claim 77, wherein said centering jaws (013) are L-shaped in section with retaining surfaces that cover a relatively large axial range of a cable sheath and ends that project directly adjacent to said knife (030).

82. The apparatus as claimed in claim 78, wherein, for controlling said rotatable knives (030) along said transport path (100), displaceable rods (060) are provided which have, in a region of said knife holders (015), wedge surfaces (016) which cooperate with diametrically opposite formations of said knife holder (015), said rods (060) coming into contact at another end with a wedge strap (018) which is displaceable along said transport path (100) by nonrotatable actuators (061).

83. The apparatus as claimed in claim 66, wherein said first and second transport means (A, B; C; 111; 112, 113)

each have at least one of one pair of rollers (A, B; 111) and one pair of continuous belts (C; 112).

84. The apparatus as claimed in claim 39, wherein at least one of an upper and a lower roller (111), continuous belts (112) of a pair of rollers, a pair of continuous belts, respectively, and upper and lower tool holders (1) are each displaceable transversely with respect to said transport path (100), relative to an opposite part in each case, so that a twisting procedure can be performed on a cable (107) lying in between.

85. The apparatus as claimed in claim 39, wherein a guide apparatus (9) which can be swiveled at least one of laterally and upward or downward is provided, which guide apparatus can be swiveled at least one of laterally and upward to increase insulation stripping lengths, in order to enable a cable (107) already lying on another side of said tools (3) to be moved back against a feed direction without collision.

86. A process for operating a cable processing apparatus having a cable processing station and tool holders, comprising:

providing a monitoring member which monitors an open state of said tool holders (1) and reduces a drive force of a drive motor (23; 16) shortly before closing of said tool holders, to bring said tool holders into a closed position with slight force, and

optionally detecting said closed position by virtue of an encoder associated with said drive motor (23, 16) that loses its steps of rotational movement notwithstanding drive energy.

87. A cable processing apparatus having a first and a second belt drive for a cable feed, as claimed in claim 39, wherein a gripping apparatus is coordinated with said second belt drive (112b), if required, said second belt drive (112b) releasing said cable (107) so that said cable (107) can be removed by a gripping apparatus.

20250227 09:23:20

## Continuous cable processing apparatus

33

The invention relates to a continuous cable processing apparatus according to the preamble of claim 5 1, having a knife station and a cable transport apparatus. Excluded from the invention are therefore cable processing machines which process exclusively cable ends or single cable sections (not continuous cable). In the knife station, cables can be cut and/or 10 processed, e.g. stripped of their insulation. For the purposes of the invention, the term knife station now also includes apparatuses for other cable processing types, such as, for example, crimping, marking or the like. The cable transport apparatus transports the 15 cable along its axis or along a transport path to and from the knife station.

Conventional continuous cable processing apparatuses operate with cable processing in the knife station, along a transport path. This type of end 20 processing establishes the processing times. However, a disadvantage with attachments involving such processing in a working area into which various processing tools or processing stations can be inserted is that it is not possible to use processing stations 25 which are longer than the distance between the transport means on both sides of the knife station. On the other hand, however, this distance should not be too large because otherwise short cable sections cannot be provided. Moreover, with a large distance, a 30 further guide element would have to be used between the receiving region of the processing station and the transport means, which is associated with an additional cost. In addition, in known continuous cable processing apparatuses the cable can be transported 35 onward only in an axial direction.

For example, the Applicant launched on the market, under the name CS9100, an apparatus which had

pairs of knives which were laterally offset with respect to the cable feed axis, which were adjacent to one another and which were capable of being laterally displaced via an upper and a lower common knife holder by a pneumatic drive in such a way that a cable fed into the apparatus along the axis could be cut into or cut through by either one or other knife. For this purpose, of course, the upper and lower knife holders were displaceable relative to one another. This has an advantage over a single knife position; at the same time, however, the disadvantage of this design in practice is the limitation of possible processing operations, which are restricted to the two knife positions.

EP-A1-365691 describes an apparatus having a pair of knives which has several blades on each knife. After conventional longitudinal cable transport, the cable is cut there by means of the multiblade knife. After opening of the knife, the cable handling components move linearly and parallel to the knife to the left or right to an insulation stripping position on the multiblade knife. The handling components on both sides of the knife with the cut cables are then displaced to the required insulation stripping length in the direction of the knife. This is followed by further knife movement to the desired insulation stripping diameter and the stripping of the insulation residue (slug) and the linear transport of the cable onwards or backwards, depending on the further processing.

A disadvantage of this means is that the two cable handling components (before and after the knife) constantly have to be displaced in the longitudinal and transverse direction, leading to considerable wear of two components highly mobile essentially independently of one another (in addition to the axial feed drive for the cable). These must also be specially adjusted to

one another in order to be able to work with the correct position and without waste. In addition, the use of a multiblade knife is uneconomical since nonuniform wear may occur and it may therefore also be  
5 necessary to replace blades which are not worn.

Moreover, this apparatus requires particular flexibility of the cable, which is otherwise liable to be destroyed.

Another known apparatus "Stripmaster Model 900"  
10 from Ideal Ind., Inc. Sycamore, USA also has die blades arranged adjacent to one another and having different effective knife diameters, so that cables having different diameters can be inserted into feed orifices adjacent to one another and can be cut by the knives or  
15 stripped on pulling out again. This apparatus is not suitable for automatic insulation stripping operations.

A further known apparatus, as disclosed in EP-A1-623982, has a swivel apparatus with which a cable can be positioned at one of two knives arranged  
20 adjacent to one another. The problem of cable flexibility occurs here too. Moreover, the cable does not rest optimally perpendicular to the plane of the knife in this apparatus, so that cuts by the knife may also be performed obliquely, with the result that the  
25 cuts may be of poor quality, unless the second knife is positioned obliquely relative to the first one. However, such an oblique position described by the EP-A1 has the disadvantage that it is optimized only for specific knives; in addition, it broadens the  
30 attachment of the knife supports. The use of other tools is not envisaged.

A further known apparatus from Eubanks Engineering Co, Monrovia, USA, with the designation "9800" has knives arranged axially one behind the other  
35 and with different cutting depths. The knives are present on a common upper and lower knife support so that an inserted cable can be subjected simultaneously

to several different processing steps along its axis. Such an apparatus is disclosed, for example, in US-A-5146673. The disadvantage of such an arrangement is a relatively low flexibility in the choice of the processing steps; moreover, the limited space between the knives restricts the possible insulation stripping length. In an attempt to increase the insulation stripping lengths, limits were encountered with regard to the maximum acceptable size of the apparatus.

In the prior art "Kodera Type 34", the insulation stripping length was limited to the distance between knife and second pair of rollers. With a special insulation stripping process in single steps, it is true that it was possible to strip individual sections with the length corresponding to this distance in succession (but not to strip the insulation away completely from the conductor but to move it a little at a time on the conductor in the stripping direction = partial stripping). The Kodera Type 36 with a greater distance between insulation stripping knives and second pair of rollers was provided to permit longer partial insulation stripping steps but had the disadvantage that short cable pieces could not be stripped with this apparatus. This circumstance is to be improved by a novel process.

A further problem is that thin flexible cables cannot be concentrically guided in the case of the guides with rigid inner diameters mounted in the known apparatuses, e.g. Eubanks 9800, which may lead to problems (more frequent breakdowns) in the cable feed.

Problems also arise in the ejection of the waste (slug) of insulation residues which are stripped from the conductor by the knife and, from case to case, were not properly removed to date, since they sometimes stuck to the conductor and thus led to breakdowns.

JP-A-1-281403 describes a multistation cable processing apparatus in which the cable to be processed

is fed to the respective stations along a semicircle by means of a pivotable distributor. The cable is either not continuous or is forcibly bent.

US-A-4009738 describes a cable insulation stripping apparatus in which cable ends in the knife region are moved parallel out of their transport path in order to compensate for disadvantageous crushing effects during cutting of these cables. As is clearly evident in Fig. 5 of this US-A, however, buckling of the cable end piece occurs.

None of the known continuous cable processing apparatuses thus offers possibilities for removing a cable from its present transport path without buckling or bending, in order to transport it to another processing station, a manipulator arm or merely to another knife within this knife station. In the case of specific cable types, this leads to considerable problems and thus restricts the universality of the relevant apparatuses.

JP-A-3-15211 describes a cable end processing apparatus which permits buckling- and bending-free transportation of a cable end from one processing station to another one, but continuous cable processing is not possible therewith since secondary transport means are lacking and it was evidently also not obvious to propose such means by appropriate complicated structural conversions. JP-A-62-217816, US-A-3653412, US-A-4244101, US-A-4446615, US-A-4833778 and US-A-4879926 describe comparable insulation stripping apparatuses which transport individual cable pieces transversely with respect to their longitudinal extension by transport means from one processing station to the other. However, longitudinal feeding of the cable by these known attachments is not known.

JP-A-9-46844 which appeared in the priority interval also relates to a cable end processing device and not to a continuous cable processing device.

Nevertheless, this document attempts to provide a solution as to how various knives can be used in a compact manner at successive times but along a cable, thus also dispensing with bending or buckling of this cable. For this purpose, the various knives are arranged adjacent to one another and can be transversely displaced on rails toward the cable in order to be able to process the cable end piece inserted in each case. After the processing, however, this must be removed from its processing position again in order to make space for the next cable.

It is thus a first object of the invention to provide an improved apparatus which permits the processing of cables, which are not to be buckled or bent. Furthermore, the processing speed should be kept high or increased. In particular, the flexibility of the processing steps and of the cable handling should furthermore be increased.

On the other hand, it is a second object of the invention to provide an improved insulation stripping apparatus which is improved with regard to the universality, permits larger insulation stripping lengths and avoids the disadvantages of the above-mentioned designs.

As a third object, it is also intended to find possibilities for processing coaxial cables continuously and in particular reliably, the universality not being restricted as a result.

These objects are achieved by various inventive steps which are described in the various patent claims. The first object is achieved by the apparatus according to the invention, having the features of claim 1. The parallel relative movement between a cable in a continuous cable processing machine and the knife station avoids cable bending or buckling, and the flexibility increases. Further embodiments are described in the dependent claims 2 and 3.

There are essentially two variants of these attachments: the knife station or its tools execute a transverse movement toward the cable (claims 4 to 24) or the cables in or with their transport means execute a transverse movement relative to their first transport path (claims 25 to 30). Mixed forms are within the scope of the invention.

Regarding the first variant:

The object is achieved by the apparatus according to the invention, having the features of claim 1. The novel knife arrangement and its drive lead to a universal, fully automatic and freely programmable cutting and insulation stripping facility. This is further supplemented by additional, novel processing steps as required. Known disadvantages are avoided. The compact design possible according to the invention is advantageous in practice and very universal.

Further features of the invention are described in the dependent claims or are evident from the information below which, with the claims, the description of the Figures and the drawings, constitute the entire disclosure of the features of the invention, some of which may also be used independently of one another.

What is important in any case is that any desired tool positions according to the invention are provided side by side and a stepping motor control is capable of selecting these tool positions in a programmable manner, so that on the one hand the cable - or several cables side by side - which is or are held in one position can be processed in different tool positions. This applies to continuous cable processing as well as to insulation stripping apparatuses where an operator or manipulator inserts a cable end into the apparatus and then pulls it out again.

Secondly, other operations are also permitted, such as, for example, sawing, incision, twisting,

deformation, crimping, etc., of the cable, by bringing together the knives or tools, closing them and laterally displacing them relative to one another. In the case of twisting jaws as tools with wedge-like oblique surfaces, this can also be realized by pure vertical movement relative to one another. Furthermore, twisting can be realized if the tool holders are designed to be pivotable about a rotation point which is as far as possible in the region of the cable axis, if the linear advance for lateral displacement of the tool holders then leads not to a displacement but to a rotation about this axis.

Further possible methods of processing exist if at least one tool holder has grinding or polishing disks which can be used for grinding the conductor ends by an oscillating or rotating movement of the knife holders, which may be important in particular in the case of glass fiber cables.

Motor control of the contact pressure or of the distance between the feed rollers or feed belts, which is provided according to the invention, has the advantage that the contact pressure on the cable can be increased during stripping in order thus to prevent slippage or in order to apply more force to the cable. If, as disclosed in the prior art, the contact pressure were to remain constant over the entire process, this would have the disadvantage that the cable or its sheath would suffer pinches over its entire length, which now occur at most in a small region. According to the invention, the wear of the belt is also reduced. Since the stripping resistance is as a rule greatest at the beginning of the stripping movement, according to the invention the contact pressure can be increased over a stripping distance of, for example, 4 mm and then reduced again to a lower level. Any marks or pinches are thus limited to about 4 mm.

The possibility of opening the rollers or belts

individually is to be regarded as a further concept of the invention, in other words the drive units of the belts, both before and after the tool holder, can be opened and closed or adjusted in their contact pressure independently of one another. Preferably, the rollers not only can be adjusted in the contact pressure and moved to a desired distance apart by means of an electric motor but they can also optionally be completely opened. The coupled opening and closing of the two pairs of rollers by means of a single drive motor and a turntable is known per se from the machine ATC 9000 of Sutter Electronic AG Thun, which was published in 1989 and whose teaching in this context is considered to have been disclosed in the context of this invention, the rollers or belts being capable of being opened completely independently compared with the known rollers or belts.

A further advantage of the possibility of opening the second pair of rollers or of belts independently of the opening of the first pair of rollers or of belts is that a preliminary stripping of, for example, 130 mm can be carried out with the aid of a first pair of rollers after the cable has already passed through the second pair of rollers by the desired length, for example 500 mm, so that even long insulation stripping lengths, for example for mains cables, can be successfully stripped of insulation. Preliminary stripping of even greater lengths is also possible, the remainder of the insulation being stripped from the conductor subsequently by hand.

Conversely, for longer complete stripping or longer partial stripping, after preliminary stripping according to the above procedure the contact pressure of the second pair of rollers or of belts could be increased and the sheath stripped from the conductor under static friction by rotation in the stripping direction.

If it is intended to strip a long piece of insulation in a few individual steps, this can be carried out according to the invention by opening the second pair of rollers or pair of belts in each partial step. Compared with the known apparatus (e.g. KODERA Type 36 with a particularly large distance between the left and the right feed rollers), there is the advantage that even short cable sections can be stripped of insulation. Compared with the known apparatus (e.g. KODERA Type 34 with a relatively small distance between the left and right feed rollers), there is on the other hand the advantage of virtually any desired insulation stripping length and absolutely no limitation to the distance between tool holder and second, axially following pair of rollers, which to date limited the insulation stripping distance in all known machines.

Regarding the second variant:

Apart from the cable processing in the (specific) knife station, the use of further processing stations may be practical, especially time-saving, for certain processing operations. The features of claims 25 to 30 are particularly suitable, especially for this aspect.

The arrangement of further end processing stations directly adjacent to the knife station and optionally also insulation stripping station accordingly permits the use of any desired processing stations. Thus, it is also possible to use processing stations which are longer than an acceptable distance between the transport means on both sides of the knife station. In a preferred embodiment, after the cable has been cut, insulation is stripped from the two cable ends produced, in two insulation stripping stations arranged side by side and transversely with respect to the cable axis. Owing to the possibility of parallel end processing, the processing time of the individual steps can be halved. However, there are also

advantages in conventional serial cable processing, due to the possibility of laterally transferring cables to transport or storage stations or the like.

Further features of the invention are described  
5 in the dependent claims or are evident from the information below which, with the claims, the description of the Figures and the drawings, represent a further disclosure of the features of the invention, some of which may also be used independently of one  
10 another.

What is important for these concepts of the invention in any case is that any desired stations, according to the invention, for the cable can be provided laterally side by side and at least one cable  
15 retaining means can be moved in a guide means by a drive apparatus, in particular a stepping motor control, in such a way that at least one cable end can be fed laterally to one of these stations. However, station is also to be understood as meaning, for  
20 example, a gripping arm or the like.

The stations which may be used permit not only insulation stripping but also other operations, such as, for example, sawing, incision, twisting, deformation, gripping, soldering, etc. Of course,  
25 additionally or alternatively, the tools may optionally be displaceably mounted and driveable transversely with respect to the cable axis within the individual processing stations.

Further processing facilities are obtained, for  
30 example, if at least one processing station has grinding or polishing disks which can be used for grinding the conductor ends by oscillating or circular movement, which may be important in particular in the case of glass fiber cables.

35 Preferably, the transport means or their rollers or belts can be opened, preferably individually. The drive units of the belts both before and after the

knife stations, can be opened and closed independently of one another or can be adjusted in their contact pressure. Preferably, not only can the rollers be adjusted in the contact pressure and moved toward one  
5 another to the desired distance apart by means of an electric motor but they can moreover optionally be completely opened. The contact pressure is preferably adapted to the processing steps in the respective processing station.

10 Compared with the known processing station, there is the advantage that both small and any desired large processing lengths, in particular insulation stripping lengths, are permitted from both ends simultaneously, without unnecessarily removing and  
15 feeding the cable ends. The processing length is not at all limited to the distance between the two transport means.

The further aspect of the invention with regard to the variants having rotating knives is described in  
20 claims 31 to 35. The other dependent claims relate to further advantageous embodiments.

Particular further developments or developments and variants of the invention are - as already mentioned - described or protected in the dependent  
25 claims. Particular processes are described in the process claims. 4, 10, 15-19, 21, 22, 25, 29-32 and 33 relate back only in particular to the preceding claims since, according to the invention, their features can also be used independently of the features of the  
30 preceding claims. Where they are dependent on these claims, this is also true of the respective subsequent claims.

Thus, with respect to the improved universal equipment of insulation stripping machines, it is also  
35 intended - according to the invention - according to a fourth basic concept - to house clamping and/or centering jaws and/or cutting apparatuses in modules

which can be added to or removed from a basic frame of an insulation stripping machine. According to the invention, it is particularly advantageous if such modules can be mounted so that they are movable and lockable, for example pivotable, in order to provide better access during servicing, for example, during changing of jaws or knives. A particular embodiment which describes this inventive concept which can also be used independently is described in claim 35.

It is noteworthy that combinations of the features described or individual aspects of the invention which are applicable independently of one another are also within the scope of the invention. This is true in particular of the features of the rotational box according to claim 31-35 and Fig. 21, 28-32.

Preferred embodiments are described with reference to exemplary Figures, which do not restrict the various aspects of the invention. The Figures are described contiguously and as a whole since - with the exception of Fig. 22 - identical reference symbols denote identical components and identical reference symbols with different indices denote similar components with the same or similar functions. The list of reference symbols and the information content of the Figures are an integral part of this application.

Fig. 1 shows a schematic oblique view of a novel apparatus;

Fig. 2 shows a variant thereof with jointly guided upper and lower tool holders;

Fig. 3 shows symbolic examples of different modular configurations of a novel modular design of an insulation stripping machine having a roller drive;

Fig. 4 shows symbolic examples according to Fig. 3 but with a belt drive;

Fig. 5a and b show a series of 8 different process

steps of an insulation stripping process according to the invention on a schematically represented structure with novel sliding guides;

- 5    Fig. 6    shows a detail of a tool holder feed according to the invention of one variant;
- Fig. 7    shows a section of a novel insulation stripping machine having sliding guides according to Fig. 5;
- 10   Fig. 8    shows a variant having a larger distance between front and rear continuous belt drive 12 with dimensions of a specific embodiment which are varied by about  $\pm 25-75\%$  in the context of the invention;
- 15   Fig. 9    shows a variant having a shorter distance and the resulting effects with values which can be varied by about  $\pm 25-75\%$  in the context of the invention;
- Fig. 10    shows a group of different tools which can be optimally used in the invention and have different applications known to a person skilled in the art;
- 20        Fig. 11    shows the left part of a plan view of an apparatus having a belt drive 12 (plan of Fig. 13) and a pivot drive for the guide;
- 25        Fig. 12    shows the right part of the same plan view;
- Fig. 13    shows analogously the left part of an incomplete view with upper belt removed and with a pivotable cable guide before the tools;
- 30        Fig. 14    shows a variant of a right part of this view;
- Fig. 15    shows a variant of Fig. 12 with roller drive;
- Fig. 16    shows process steps according to the invention for stripping insulation from larger lengths;
- 35        Fig. 17    to 20 show schematic representations for illustrating a process according to the

- invention for programming the control;
- Fig. 21 shows a detail of a knife drive of a station according to Fig. 28;
- Fig. 22 shows a schematic structure having a transverse transport facility for the cable;
- Fig. 23 shows a schematic representation of transversely displaceable transport units;
- Fig. 24 shows a variant of Fig. 23 having combined transverse displaceability of transport means and knife station;
- Fig. 25 shows a realistic structure according to Fig. 23;
- Fig. 26 shows the structure according to Fig. 25 in the transversely swivelled state;
- Fig. 27 shows a structure having transport units displaceable independently of one another;
- Fig. 28 shows a knife station having rotatable knives;
- Fig. 29 shows the station according to Fig. 28 as a mounted module in the swivelled-out state and in the operating state;
- Fig. 30 shows a front view of the station according to Fig. 28;
- Fig. 31 shows a section through the station and
- Fig. 32 shows a detail of the centering jaw control in the station.

Fig. 1 shows a schematic oblique view of a novel apparatus according to the invention, having tool supports 1, 2 and knives 3 which are held thereon and a plurality of which (more than the 2 pairs shown) may be mounted side by side on larger tool supports 1, 2. Schematically shown drives 5a and 5b drive the tool supports laterally relative to the axis 106. Schematic closing drives 16a and 16b enable the tool holders 1, 2 to be closed together (via a control) or separately. A guide 17 keeps the tool supports or tool holders and the drives parallel.

Fig. 2 shows a variant thereof having upper and lower tool holders 1, 2 jointly guided via a closing drive 16c, for example by means of a spindle drive and a single lateral drive 5c. This simplified variant is compact but - in comparison with the first one - permits only a few operations.

Both above-mentioned Figures refer to an important aspect of the invention, namely the virtually completely free mobility of at least one cable processing tool, in particular a knife or the like, in a plane approximately perpendicular to the cable feed direction. The mobility might also be continuous if required.

Fig. 3 refers to an independent novel aspect of a modular design of an insulation stripping machine, but an aspect which can preferably be used in above cable processing machines. Examples 1b to 4b schematically show feed modules A and B having rollers, which however could in some cases also be replaced, for example, by other feed modules, for example a feed module C having belts according to Fig. 4, so that, for example, a feed module A is supplemented with a feed module C with omission of the module B.

A further frequently used module D having a pivotable guide tube is used before a blade or knife module E. The knife module is preferably designed as shown in Fig. 1 or 2, a further rigid or displaceable guide preferably being arranged. Fig. 11 illustrates the function of the pivotable guide tube.

As shown in Examples 3b, 4b and 3a and 4a, modules D and E can be replaced by module F which has at least one displaceable guide but preferably, as shown, two displaceable guides which permit a novel special insulation stripping process, as illustrated in Fig. 5a and b.

According to the invention, the insulation stripping apparatus can be supplemented by any desired

further modules, a module G which represents a "coax box" being shown as an example, namely a rotating incision box and may be used in particular for coaxial cables. Such a coax box has been brought onto the market, for example, by Schleuniger AG under the name CA 9170, and its design will therefore not be discussed in detail. A person skilled in the art can readily adopt the relevant teaching from there. It is thus considered to have been disclosed in the context of this application. However, this application relates to a novel rotating cutting module which has advantages over CA 9170. It is distinguished in particular by a simple knife control and completely independently controllable centering jaws, as shown in Fig. 28.

What is important in this independent aspect of the invention is that a basic design is offered which makes it possible to meet the insulation stripping needs in a universal manner. The resulting advantage is primarily in the production, since the modules can be produced and stored in the factory independently of one another. Secondly, there is an advantage for the user, whose insulation stripping needs may change with time. By replacing the appropriate modules on site, the apparatus according to the invention can be subsequently adapted. The technical realization of this aspect lies in linear guides in the basic housing, which interact with diametrically opposite guides on the modules, so that the modules with their operating elements are concentric with the cable feed axis 106. In comparison with the prior art, this also permits faster assembly of complete insulation stripping or cable processing apparatuses.

The novel and advantageous process steps shown in Fig. 5a and b constitute a third - optionally also independently applicable - aspect of the present invention. By means of short, in particular linearly displaceable guide sleeves 40a and b, the cable end

sections are each held centered - advantageously - in the immediately vicinity of the knives before incision or insulation stripping by the knives 3a and b. For applications not described in more detail, it is of course also possible for the purposes of the invention to dispense with one of the two guide sleeves 40, in particular when the belt or roller feed is subsequently moved closer to the knives 3. A further variation arises through the possible replacement of a guide sleeve 40 by a module D, as shown, for example, in Fig. 16. The belt drive shown schematically as module C can be interchanged completely or partially with roller drives.

The inventive aspects of the invention which do not refer directly to the lateral displaceability of the tools are of course also applicable in an inventive manner to knife arrangements in which a plurality of knives 3 are arranged staggered along the cable axis (feed axis) 106, as, for example, in the insulation stripping model CCM 2000 of Sutter Electronic AG. Such combinations might make it possible further to increase the processing speed of cables by the process steps according to the invention and displaceable guide sleeves.

In an alternative design, in particular with utilization of the modular aspect, it is accordingly also possible to provide a plurality of knife modules F with laterally displaceable knives one behind the other. Variants having additional feed modules A, B or C arranged in between are also within the scope of the invention.

The invention furthermore relates to a novel measuring and adjusting apparatus for jaws which can be driven together by means of a motor, in particular cutter jaws on an insulation stripping machine. The novelty is the utilization of a certain elasticity between drive motor and an advance spindle which is

responsible for advancing the jaws. The elasticity is generated by an elastic coupling member between drive motor and spindle, in particular a toothed belt which transmits the torque of the drive to the spindle via pulleys. A further novelty is that a transducer, in particular an encoder (shaft encoder), is mounted directly on the spindle. When the jaws are driven together, contact between the jaws is signalled to the encoder by virtue of the fact that the jaws no longer move together and the definitive stop position can thus be read or tapped from the encoder or a reset can be signalled. Owing to the elasticity, the drive motor, for example a stepping motor, can, however, continue to rotate slightly further according to the invention against the elasticity of the toothed belt, if only to absorb its motor force without imposing a mechanical load on the jaws.

According to the invention, the closing position of the jaws can also be deduced from the fact that one transducer (on the spindle) has come to a stop and the other (e.g. stepping motor) may still continue to rotate slightly. In addition or as an alternative, it is possible within the scope of the invention to reduce the torque of the drive motor in the vicinity of the closed position in order to reduce the mechanical load on the closing jaws.

An optional intermediate step according to the invention in stripping with the aid of the right belts with controlled contact pressure advantageously leads to complete stripping of long insulation pieces, with the advantage that jumping over the insulation stripping knives under strong retaining forces between conductor and insulation is reduced. However, this is a problem only in the case of thin cables; in the case of greater thicknesses and especially greater insulation thicknesses, known apparatuses as a rule otherwise lead to blocking of the left belt drive or to

slippage which in turn may lead to destruction of the cable or of the left belts.

The completely individual adjustability and controllability of the front and rear rollers or belts facilitates the further processing of the cable but also requires adequately dimensioned drive motors and suitable software which, in the understanding of this patent application, is clear and realizable to an average person skilled in the art.

The preferred process steps in steps 1 to 8 are characterized by:

- 1 Feeding the cable 7 to its front insulation stripping length behind the knives 3; moving away the rear guide sleeve 40b.
- 2 Closing the knives 3 to the insulation stripping depth and withdrawal of the cable 7 by means of front module C.
- 3 Positioning the rear guide sleeve 40b, which simultaneously - if required - ejects the waste insulation piece so that it does not hinder the further procedure. It is precisely this procedure which is particularly advantageous over known solutions from Eubanks, which offers two-part guide sleeves which are intended to open for removing the waste and to eject the waste by means of an additional mechanism. Since these known attachments, however, subsequently close again, waste residues can actually now become jammed between the guide sleeve parts, which does not occur according to the invention. As a solution, another prior art envisages forming the sleeves to be open at the bottom so that stripped material can fall out downward. The disadvantage of this design is that cables, in particular thin, flexible cables, are not guided at their lower surface and faults may therefore occur during operation. Such guides are disclosed, for example, in the case of the insulation stripping model from Koderer/JP "Koderer 34".

4 Feeding the cable 107 up to the cutting position under the knives 3. In the case of a design according to Fig. 1 or 2, which is not obligatory for the use of this novel process, the insulation stripping knives 3 and the cutting knives 3 are arranged side by side on the displaceable knife supports 1, so that the cutting knives 3 are displaced to the cutting position between steps 4 and 5 while in the other steps the insulation stripping knives 3 are in the position shown.

10 5 The cable 107 is cut through.

6 The second cable section 107b is pushed back by means of the rear feed module C up to the insulation stripping position of the rear cable end; the front guide sleeve 40a is moved away. The latter has, inter alia, also the effect of making it possible to strip the insulation from a longer cable end section which exceeds the length between front module C and knives 3. Provided that it is flexible enough, this cable end section can in fact be bent since it is not laterally guided by the front guide sleeve 40a. The same effect can, if required, be utilized in steps 1-2, also at the front cable end and the guide sleeve 40b.

7 Incision and stripping of the insulation section (cable sheath waste or "slug").

25 8 Ejection of the cable section 107b stripped at both ends and feeding of the next cable section 107a according to step 1.

Fig. 6 shows a detail of a tool holder feed according to the invention (e.g. module E or F) of a variant according to Fig. 2 with a threaded spindle 18, a toothed belt drive 24 and the stepping motor 23 for controlled driving of the closing and opening movement of the tools and a schematically indicated drive 5 for lateral displacement of the knife holders 1 and 2.

35 With regard to the insulation stripping steps 4 and 5 according to Fig. 5, the pair of knives 3e and f are used, whereas the die blades 3g and h merely cut into

and strip off the insulation. The die blades 3g and h are preferably so compatible that they support one another and overcutting is thus impossible.

This compatibility, as is also already known in the case of other known insulation stripping machines, leads to an adjustment problem, which is solved, according to the invention, by another aspect of the invention, independent of the other aspects. In the case of inaccurate setting of the drive with the motor 23 or in the case of different knife inserts in the knife holders 1 and 2, the motor force may result in undesired forces on the spindle 18 or on the knife holders 1 and 2 if in fact the motor 23 applies further torque when the knives 3g and h rest against one another.

This problem is avoided by a shaft encoder 41 directly on the spindle 18. The encoder, together with a control not shown, has the task of monitoring the rotary movement of the spindle 18 as a function of the drive or rotary power of the motor 23. If the motor continues to apply torque without the spindle 18 rotating (no change in the encoder value), the control independently detects that the knives 3g and h are abutting one another. The elasticity of the toothed belt 24 permits a certain play which avoids mechanical overloading of the spindle. In a special embodiment, the encoder of the motor 24 - e.g. a stepping motor - is also used for comparison with the encoder 41 in order to detect the closed knife position. An initial sensor 42, for example an inductive sensor, may be provided in order to detect the open position of the knife holders 1 and 2.

Fig. 7 shows a module F by way of example in more detail. The guide sleeves 40 are preferably held in holders 43 on guide rods 44 which can be raised or lowered by - in this example pneumatic - drives 45 under computer control. According to the invention, the

holders permit rapid changing of guide sleeves 40 in order to adapt them to various cables. The guide sleeves 40 are preferably countersunk in a funnel-shaped manner in their interior at one or both ends to facilitate cable introduction. For certain applications, they may, as already mentioned above, be replaced with conventional pivot guides or completely omitted. According to the invention, they can also be successfully used in any other insulation stripping machines; for example, also in conventional rotary insulation stripping apparatuses, instead of co-rotating centering jaws, such as, for example, in the models 207 from Schleuniger Productronic AG or the models 9200 from Eubanks Monrovia, USA, which have now been taken off the market. Between the guide sleeves 40 are the knives 3 or the cable processing tools, and optionally a compressed air blow-out orifice 46 for cleaning the tools.

Fig. 8 shows a variant according to modular design 1a (Fig. 4) with a larger distance between front and rear continuous belt drives 112 with dimensions of a specific embodiment which can be varied by about  $\pm 25-75\%$  for the purposes of the invention. The pivotable guide 9 permits long rear insulation stripping sections since, when a front cable section is pushed back, the guide 9 swivels upward and thus leaves free the path for the rear end of the front cable section, at least up to the length of the pivotable guide 9. The pivotable guide 9 is positioned opposite a guide 17 which may consist only of a flat guide piece for horizontal guidance of a cable, but which may also be displaceable, as described above, or may be formed to be rigid but replaceable, the above-mentioned snap fastenings also being advantageous according to the invention for this purpose. The length of these guide pieces or the distance between the knives and the belt or roller drives is usually critical for the smallest

processable cable length. According to the invention, however, there is also a special short-mode operation in which the second pair of rollers or of belts is shut down in order to be able to process even shorter cable sections.

In contrast, Fig. 9 shows a variant with a shorter distance, such as, for example, modular design 3a (Fig. 4), and the resulting effects with values which can be varied by about  $\pm 25-75\%$  for the purposes of the invention; of course, the belt drives 112 are replaceable in both variants by roller drives 111.

In a particular, novel inventive aspect which may also be used independently, the belt drives 112 can however also be used for stripping the cut cable sheath sections, the respective belts - as a rule these will be the rear belt pair - continuing to transport the cable sheath in the stripping direction by means of the contact pressure control, according to the invention, of the belt drives 112 as a function of the cable structure in case of closed insulation stripping knives which thus hold the cable. In a particular variant, the front belts, too, can run in the opposite direction and thus help to pull the conductor out of the sheath in a shorter time.

According to the invention, partial stripping operations with subsequent complete stripping with the aid of the belt drives, as described above, are possible as further process variants.

The modes of operation of the knife embodiments according to Fig. 10 are essentially known to a person skilled in the art; only attachments a-c will therefore be singled out:

In the case of particular attachments a), it is also possible to process in parallel a plurality of cables with the apparatus according to the invention, leading to greater effectiveness. According to the invention, parallel guides 40 or pivot guides 9 are

then also provided for this purpose.

The particular attachment according to b) serves for stripping the insulation from flat cables, which can also be processed within the scope of the invention. Here, the flat blades according to b1) are preferably used for cutting.

The variant having the knives c) is likewise used for flat cables, and the latter can also be cut therewith.

The plan view according to Fig. 11 is compatible with the view according to Fig. 13. A front belt drive 112a with its drive rollers 111b and d transports a cable along the axis 106 to the pivotable guide 9. This has a guide tube 9b which is replaceably held in a pivot member 30b. The pivot member 30b is connected to a connecting rod 34 which transmits the pivot movement from the drive 33 to the tube 9b, while a stop 31 having a rubber buffer 31b for damping is coordinated with the pivot body 30 or with the connecting rod 34, since the longitudinal guide 9 is preferably driven by means of a fast-acting displacement magnet 32 which accelerates the guide 9 abruptly by means of its slide 33, which may also be damped by means of a rubber buffer.

In the present embodiment, the connecting rod is formed in two parts, a straight pin 34a being held in a rotating shaft 34b and the latter in turn in a bearing 35 which is connected to the pivot member 30b. If required, this pivot guide may also be spring-loaded and/or may be arranged rotated about the axis 106 through 90 or 180 degrees, so that the guide 9 does not swivel upward but swivels out laterally or downward.

47 denotes an adjusting drive for the belt drive 112, which turns the spindle 14b by means of a belt 48.

Fig. 12 shows the right part of the same embodiment, 25 denoting the drive and 24 the belt for adjusting the tensile force of the continuous belt

drive and 26 denoting the controlled (stepping) motor which permits controlled lateral guidance of the tool holders 1, 2 in the linear guides 27.

In this embodiment, the guide 40b is not  
5 displaceably held but is held by means of holder 43b so that it is readily removable. A common retaining part 8b displaceable by means of drive 5d carries the tool holder 1.

Fig. 13 shows a detail of the belt drive 112a  
10 for the novel apparatus having a continuous belt pair 112 with belts (toothed belts) 13, rollers (toothed rollers) 111a, c and pressure rollers. The upper and lower belts can be separated completely from one another. The contact pressure between the belts 13 is  
15 controlled by means of the pressure spring 29 which holds the drive roller retaining member 50 under initial tension in the closing direction. The initial tension is increased by turning the spindle 14b further in the closing direction with upper and lower belts 13  
20 touching one another, so that the lock nut 51b further compresses the spring 29. On opening the belt drives, for example for preliminary opening to avoid damaging contact between a cable and the belts 13, the lock nut 51b drives the drive roller retaining member 50b by  
25 means of the driver part 52b.

The opening movement is limited by means of adjustable stop 53. In this position, the closing movement is preferably simultaneously initialized. The control is effected either by means of a shaft encoder  
30 (not shown) on the shaft 14b or by means of the controlled drive 47 according to Fig. 11.

In the variant according to Fig. 14, the drive motor 54 for the belt drive is indicated by a dashed line and is preferably likewise encoder-controlled  
35 since it plays a role in determining the insulation stripping lengths.

Fig. 15 shows a variant of Fig. 12, having a

Fig. 16 relates to a further novel and inventive process for stripping insulation from cables, which could preferably be carried out using the attachments described above, but also with other known machines in a novel manner. In four process steps, a cable 107 is stripped of a particularly long insulation section:

2       Opening the right belt drive 112b to the cable  
15   diameter so that the cable is just held centered, but  
without exerting a contact pressure thereon. At the  
same time, incision by the knives 3 to the insulation  
stripping depth; withdrawal of the cable 107 by  
backward revolution of the belt drive 112a to about the  
20   position in which this belt drive 112a does not yet  
touch the bare conductor 57. This would be an  
insulation stripping length which could be achieved to  
date only by means of expensive partial stripping  
steps.

4 A person skilled in the art recognizes that further steps would be possible.

A particular process for controlling the  
35 insulation stripping apparatuses described above or  
other insulation stripping apparatuses which are not  
within the scope of the above embodiments is likewise

the subject of this application.

The object of the process is to improve, in particular to accelerate, processes known per se for controlling insulation stripping apparatuses, so that internal sequences are optimized and certain functions automated and optionally the input is further facilitated.

Known processes for control have software which, when processing special cables (e.g. coax cables), offered the possibility of manually inputting each individual operation, i.e. each process step, each individual feed or withdrawal, for example of the cable or of the knives, each pivoting of a pivotable cable guide part, etc. and of thus programming the software in such a way that it subsequently appropriately controlled the machine. This required "complete" programming of the entire insulation stripping process for each new detailed problem in stripping the insulation from a special cable. This is time-consuming and may also be liable to errors owing to mistakes.

The present invention solves this problem satisfactorily for the first time by introducing groups of operations which combine process steps and automatically make certain adjustments group by group. Each process (step) group performs a frequently required task which consists of a plurality of individual process steps, for example successive incision and feeding of a three-stage cable on one side with adjustable insulation stripping depths.

According to a further development of this process, the individual process steps in a group of operations or the associated values can be set to 0 or can be replaced by other, random values, making it possible to generate a new, alternative group of operations. This makes it possible for the user to store each special cable as a group of operation groups in a database, in which he can subsequently simply

select the cable by means of a command.

According to a further development of this invention, such groups of operations may also be combined to overlap (for example to form larger groups of operations), in order automatically to solve more complex insulation stripping problems (for example, cables having an extremely large number of insulation stripping stages).

This therefore results in modular blocks of process steps, which blocks are preferably each freely programmable by themselves.

As a rule, in the event of a cable change, a user need therefore only select one or other cable in the database in order to control the stripping of insulation from the cable in the desired manner.

According to a particular embodiment of the invention, the program (module) groups are shown on a display. Fig. 17 shows an example of such a display, together with the scheme of a desired stripped cable section. The cable and its processing operation groups are shown schematically on the display. A menu bar is also shown.

Completely normal three-stage stripping is shown on the far left in the scheme. This is followed by the fourth stage of stripping, consisting of a slotted window without left end and without slit, which is partially stripped over a large length. The next operation comprises a text. This is followed by the right end: complete stripping. This comprises repeated stripping in one piece (there are other possibilities, but this is the recommended one). This end is additionally processed (e.g. crimped) by an external device.

The individual operations are thus shown schematically in succession. The individual operation symbols may not be completely displayed, but in each case the selection which the user chose by inputting

the parameters. The cable contains empty parts at most at the end. If it consists of few operations, it will simply be shorter. A very large number of operations may lead to the cable being scrolled. The display jumps about half a screen in each case. The display is not true to scale either in X or in Y.

Two bars are shown below the cable. The upper, thick bar indicates which operation is currently being actuated by the user (for choice of other operations, see under Keys, Enter and Back): the thinner bar or bars shows or show which operations are currently overlapping the actuated ones. Those which do not at all overlap are not shown (such as the text); others which end somewhere within the first, end in the middle; those which end in the same place as the thick bar actually end there; and those which extend beyond (such as the stripping of the outermost layer) also extend beyond the thick bar. Up to two overlaps per side are shown, and further ones are indicated by three dots on the appropriate side. Operations which lie completely one under the other are shown as a line of half length in the middle of the other operation.

The selection menu for the operations of one end is shown underneath. Details of the menus are shown, for example, as follows:

Various menus are available for selection. One menu (End menu) is activated when the user is at one end of the cable. The other menu (Middle menu) is activated when the user is not at one end of the cable. For a list of operations and the functions controllable thereby, see further below. If one of the appropriate keys is pressed, a new operation is introduced.

Fig. 18 shows and describes, by way of example and schematically, possible groups of operations for processing the cable end, while Fig. 19 provides information, by way of example, on groups of operations for the middle part.

Fig. 8 shows a universal guide 17 (only horizontal guidance). This is, if required, adapted to the cable diameter. A guide 9 which can be swivelled away is, if required, adapted to the cable diameter.

5 The cable sections shown relate to the following processing possibilities: processing in short mode if L is less than 52 mm, processing in special mode if right insulation stripping length is greater than 50 mm. The insulation can also be stripped off in several  
10 sections. The advantage of this variant: it is faster than the variant according to Figure 9 and it permits greater left and right stripping length. Disadvantage of this variant: the cable swivels out with guide 9. Short coax cable sections cannot be processed.

15 Fig. 9 also shows one universal guide 17 each on both sides (only horizontal guidance). It is adapted to the cable diameter. It can be swivelled away. The cable sections shown relate to the following processing possibilities: processing in short mode if L is less  
20 than 52 mm; processing in special mode if right insulation stripping length is greater than 50 mm. The insulation can be stripped off in a plurality of sections. Advantage of this variant: no swivelling out of the cable; processing of relatively short coax cable  
25 is possible. Disadvantage: slower than variant according to Fig. 8; max. 50 mm stripping length on the left side; max. 50 mm complete stripping on the right side.

30 The processing facilities indicated on the screen shown by way of example in Fig. 17 are schematically represented in Fig. 18. The operations have the following special features according to the invention:

- 1) Terminating: Stops until the input signal (robot)  
35 indicates completed processing.
- 2) Coax slit: Always displayed; however, processing takes place only if a coax box is also set in the

system parameters. This is so that it is possible to inspect coax wires quickly even if no coax processing is to be performed. A person skilled in the art understands coax box as meaning an additional module with rotating knives for cutting into coaxial cables.

3) Coax steps: Can be used for stripping up to three steps (four layers). Stripping for the appropriate steps can also be defined here.

4) Cutter strip: Permits multiple stripping (without coax, whereby coax operations can be positioned "independently" thereof at the desired point). However, this may also be one-part stripping - both complete and partial stripping are possible. It is also possible to define multiple windows (free windows in the cable). The graphics for Cutter strip show the process first as a procedure, with the result underneath.

5) Cutter slit: Permits the definition of a slotted end with tearing of the insulation for easier removal.

Since each individual operation can be omitted, various possibilities are available for selection (see below). This process is analogous to operation 2, except that the knife head is used instead of the coax box.

6) Cutter steps: Can be used for stripping up to three steps (four layers). Stripping for the appropriate steps can also be defined here. As for operation 3, except that incision is performed with the knife head instead of with the coax box.

The operation groups in the middle part according to Fig. 19 permit their positioning in each case starting from the left or right end. This results in the following special features according to the invention:

1) Stopping: Stops until the input signal indicates completed processing.

2) Marking: Marks an area with a number of texts. It

is also possible to mark a single text.

3) Coax slit: Permits the definition of a slotted window with two-sided tearing of the insulation for easier removal.

5 4) Cutter slit: Permits the definition of a slotted window with two-sided tearing of the insulation for easier removal. Since each individual operation in 3 and 4 can be omitted, this makes the procedure versatile. As for operation 3, except that incision is  
10 carried out with the knife head instead of with the coax box.

Various basic operations according to the invention for the ends are shown in Fig. 20a-e:

Fig. 20a schematically shows a basic operation.

15 Fig. 20b shows, in the upper diagram, a basic operation with coaxial incision, longitudinal cut and stripping with the knife head, the codes beginning with SPE being cable-specific and/or operation group-specific.

20 Fig. 20c shows a basic operation with first coaxial incision, second coaxial incision, third coaxial incision and the corresponding insulation and layer stripping, beginning from the diagram with the shallowest incision through stripping with the next  
25 deepest incision to stripping with the deepest incision. The recommended operations are shown schematically underneath in extract form.

Further variants are: also incision in two stages or one stage or omission of individual cuts and associated  
30 strippings or omission of each individual stripping of all of the total of six possible ones.

Fig. 20d shows a further basic operation for cutter stripping with the following steps: 1. outer incision, 2. stripping to the outermost incision, 3.  
35 next incision, 4. stripping to this incision, ... The following parameters must be input: first incision position: length of all sections (one value only),

length of the first strip, length of all other strips (one value only).

Fig. 20e shows, in the upper diagram, a schematic basic operation for marking. The lower diagram schematically shows a further operation according to the invention. This is an operation involving a coaxial window with the following process steps: 1. right coaxial incision, 2. left coaxial incision, 3. longitudinal slit, 4. right stripping with the knife head, 5. left stripping with the knife head.

A schematic embodiment for the transverse transport of cables to other further processing stations is shown in exemplary Figure 22, which does not restrict the various aspects of the invention. The Figure shows a perspective view which schematically indicates some components of a cable processing apparatus - comprehensible to a person skilled in the art.

Fig. 22 shows a first and a second transport means 112, 113 of a cable transport apparatus for moving and holding a cable 107. The cable transport apparatus comprises, in addition to the transport means 112, 113, for example, a cable roll with a stock of cable, a guide means for controlled feeding of the cable 107 from the cable roll to the first transport means 112 and a receiving apparatus for receiving the cable sections, cut to length and processed at the ends, from the second transport means 113. The two transport means 112, 113 each comprise at least two rolls which can be pressed from opposite sides against the cable 107 and of which at least one is driveable so that the cable 107 can be moved forward, or away from the stock of cable, or backward, depending on the direction of rotation. When the rolls stop, the cable 107, too, is held without movement.

In the embodiment shown, the transport means 112, 113 each comprise an upper and a lower belt 4 and

5. These belts are each guided around two rollers 6. Of an upper and lower interacting belt pair, at least one belt can be driven in both directions. For this purpose, for example, one of the rollers 6 or a further roller acting on the belt is connected to a drive. The rollers 6 of the belt 4 or 5 are each rotatably mounted on a roller frame 7. The roller frames 7 are in turn mounted in U-shaped holding carriages 8, at right angles to the longitudinal cable axis, to permit parallel displacement. As a result of the movement of a roller frame 7 with the rollers 6 of the upper belt 4 upward or downward, and correspondingly of a roller frame 7 of the rollers 6 of the lower belt 5 downward or upward, the receiving area for the cable 107 can be enlarged or reduced. To activate the displacements of the roller frames 7 and to achieve a contact pressure between the belts 4, 5 and the cable 107, actuating elements 9 are preferably arranged between the holding carriage 8 and each roller frame 7.

Each holding carriage 8 is displaceably guided along a track transversely to the longitudinal cable direction by means of a guide. The embodiment shown provides, for each holding carriage 8, a linear guide in the form of a rail 10 whose guide profile 10a is engaged by a corresponding guide part of the holding carriage 8. In order to move the holding carriages 8 along the rails 10, for example, one stepping motor 11 each is provided, each of which sets in motion a cable 13 by means of a drive wheel 12. One end of the cable 13 is connected directly to the holding carriage 8 and the other end is connected via a deflecting roller 14 to the opposite side of the holding carriage 8 to form a continuous belt by means of which the carriage 8 can be moved in both directions.

Of course, it is also possible, if required, to provide pivot guides instead of linear guides for the holding carriages 8. The guide means for controlled

feeding of the cable 107 from the stock of cable to the first transport means 112 must ensure, for the possible displacements or swivel movements of the first transport means 112, that the cable 107 is not curved more than desired. If necessary, the cable roll with the stock of cable is moved together with the first transport means 112 or its holding carriage 8 so that the cable 107 always directly reaches the first transport means 112.

At least one knife station 115 and, for example, a further processing station 16 or 17 is arranged between the first and second transport means 112 and 113 or the rails 10. To produce cable sections 107a, b, the cable 107 is guided from the first transport means 112 through the knife station 115 to the second transport means 113. Two cutting tools 3 can be moved together for cutting through the cable 107. The knife station 115 comprises, for example, a knife frame 19 in which the cutting tools 3 are guided and on which movement elements 20 for actuating the cutting tools 3 are fastened. If necessary, a centering guide 21 which may be movable by means of a linear guide 22 on the knife frame 19 is provided for guiding the cable 107 from the first transport means 112 to the cutting region. The displaceability of the centering guide 21 makes it possible to feed the cable 107 with or without the centering guide 21 to the cutting region. If the cutting region also includes sections for insulation stripping, the centering guide 21 can be displaced, for example, parallel with the first transport means 112. Preferably, centering apparatuses are provided on both sides of the cutting tools 3, it being expedient during stripping of the insulation if the free wire end is not present in a centering guide 21. The centering guide 21 is actuated by means of an adjusting drive 23.

In order to reduce in relative terms the processing time also with a knife station 115 for

cutting and insulation stripping, the cutting tools 3 are preferably provided with a central cutting region and, on both sides thereof, with one insulation stripping region each, so that, after cutting, the resulting two wire ends can each be fed individually to an insulation stripping region by movements of the transport means 112, 113 in opposite directions. For insulation stripping, the two wire ends are each moved by a desired length through the knife station 115. The cutting tools 3 are then moved together for cutting the insulation layer and the two wire ends are drawn back again by the transport means 112, 113 from the knife station 115 for stripping the insulation. The shorter processing time is the result of the simultaneous processing of the two wire ends, which is permitted by the lateral displacement of the wire ends relative to one another. To permit any desired insulation stripping lengths, the lateral displacement is preferably chosen so that the advanced wire ends can be moved laterally past the opposite transport means 112, 113. If necessary, each transport means 112, 113 is assigned a lateral support region on which the advanced cable end, resting on the opposite side, is guided so that it is not curved downward in an undesirable manner even in the case of large insulation stripping lengths.

Analogously to the simultaneous processing of the two cable ends 107a, b in laterally staggered insulation stripping regions of the cutting tools 3, it is also possible to ensure simultaneous processing in any other desired processing stations 16, 17 arranged staggered laterally or transversely to the longitudinal cable direction. By means of the lateral displaceability of the transport means 112, 113, simultaneous or parallel processing is permitted. In addition, processing stations 16, 17, which are accessible only from one side for a cable end 107a, for example through an insertion orifice 16a, can be of any

desired length or may also extend laterally along a transport means 112, 113 without this having an effect on the distance between the two transport means 112, 113.

5           If necessary, during the processing of one cable end 107a, b, the other is drawn back and the processing tool is moved transversely to the longitudinal cable direction toward the cable 107. However, this method of processing permits only serial processing of the  
10 cable ends 107a, b formed on cutting. Because this particular solution according to the invention eliminates the restriction to processing in the region of a single fixed cable axis 106, the processing can be accelerated and simplified. The acceleration is  
15 ensured by the parallel processing. The simplification arises because, in order to achieve freedom of movement of the cable end 107a being processed, no movements of the other cable end 107b need be performed.

          It is clear that upward and downward mobility  
20 can also be provided instead of or in addition to lateral mobility of the transport means 112, 113. In other words, stations can be arranged distributed as desired about a central axis or a knife station, it being necessary for the transport means 112, 113 or  
25 their guide means to ensure that the cable ends 107a, b can be fed to the processing station. The movement of the cable end 107a, b upward or downward can, if required, be achieved by the movement of the roller frames 7 in the holding carriage 8 upward or downward.  
30 In addition, at least one transport means 112, 113 may also be displaceable in the longitudinal cable direction, so that, for example, it may be possible to dispense with a centering guide because the outlet region of the transport means 112, 113 can be guided  
35 directly to the entry region of the processing station 115, 16, 17.

The schematic diagrams in Fig. 23 and 24 are

self-evident, in Fig. 23 the lever 101 representing any desired actuator between the transport means. The fork according to Fig. 25 and 26 serves as an example of such an actuator.

5           Fig. 24 on the other hand shows any desired actuator 101 between a transport means 112b and a knife station 115h. By simultaneous movement of the transport means 112b and the tools, it is possible to save transverse transport time.

10           In particular, Fig. 26 clearly illustrates a time-saving insulation stripping method by simultaneously stripping the insulation from the front and rear cable end 107a and 107b. This design is shorter than a design having a three-knife arrangement  
15           one behind the other, like, for example, Eubanks Model 9800.

          Fig. 27 shows an independent transverse transport, for example along a drive roller axis 110 for the transport unit 112b. In Fig. 25-27, the  
20           double-headed arrow indicates the mobility of the drive elements toward and away from one another.

          The further Figures 28-33 describe another design according to the invention, which is used in particular as a "rotating box" in continuous cable  
25           processing machines. As a rule, it is added on as a module and used in addition to the knives which are generally not rotatable in such machines, in particular V-knives, in order to facilitate particularly hard insulations or multistage insulation stripping  
30           processes in the case of coaxial cables. The length measurement required in the case of this design is effected as a rule at the drive rollers or drive belts of the continuous cable, which are located on both sides of the rotating box and, in addition to feeding,  
35           also perform a clamping function and, if required, a centering function. Figures 28-33 are likewise described contiguously and in an overlapping manner.

Mounted by means of a rigid sleeve 027 is a hollow jaw shaft 022 which is connected by means of a coupling to brake disk 001 with a gear wheel 024 which can be driven by means of a toothed belt. The jaw shaft 022 transmits the torque of the gear wheel to a spiral flange 012 which engages centering jaws 013 by means of a pin. Since the centering jaws 013 are guided in a jaw guide 011, a rotation of the spiral flange 012 results in the clamping or centering jaws 013 moving together or apart. By means of adjusting nut 029, it is possible to tension a pressure spring 025 which influences the braking force between brake disk 001 and first gear wheel 024. The braking force decides on the contact pressure of the centering jaws 013 on the outside of the cable sheath. The centering jaws 013 have an L-shaped section so that they permit a very compact design and nevertheless offer a broad centering or clamping surface for cables to be stripped of insulation. Their ends project to directly adjacent to the knives. However, owing to their L shape, it also offers space for any guides or the like.

A bearing flange 008 which carries bearings 041 is arranged coaxially with the jaw shaft 022. The bearings 041 support a knife head which has wedge clamps 018 which are equipped in the region of a head flange 015 with wedges 016 which cooperate with diametrically opposite knife holders 015. The knife holders 015 are guided in a knife guide 010. A spindle 006 drives a nut 005 axially; subsequently, the wedge clamp 018, too, is longitudinally driven via a bearing 042. The spindle 006 can be driven by a second gear wheel 020 which has a position indicator 003 whose counterpart is connected to the nut 005. A straight pin 044 secures the nut 005 against rotation, so that rotation of the second gear wheel 020 results in an axial displacement of the nut 005 and hence an axial displacement of the wedges 016. This displacement

causes the knife holders 015 to move in the closing or opening direction. However, other closing and opening apparatuses known to a person skilled in the art for knives and jaws are also within the scope of the invention.

Fig. 29 shows a plan view of a rotating box 057 according to the invention in a mounting position on the left and in the insulation stripping position on the right. The further attachment of a continuous cable insulation stripping apparatus 058, for example Schleuniger insulation stripping machine CS 9100 or a novel machine CS 9150 according to the invention, is indicated by dashed lines. Swivelling out of the insulation stripping position into the mounting position permits better access to the rotating box 057 in order, for example, to facilitate knife change. Swivelling out thus permits rapid working according to the invention. The module 057 is held on a hinge 059 which is screwed to the frame of the continuous insulation stripping apparatus 058. A conventional lock secures the module 057 in the insulation stripping position. This concept of the invention is not restricted only to rotating boxes but includes all modules of a continuous insulation stripping machine.

Fig. 28 shows an oblique view of the rotating box 057 according to the invention, in which the insulation stripping knives are in the zero position (closed). In contrast, Fig. 30 and 31 shows the diagram with opened, i.e. retracted, wedges 016. Further descriptive information appears in the list of reference symbols.

In the present application, reference is made in particular to clamping, centering and knife jaws. However, attachments which do not relate exclusively to jaws but, for example, also include centering or insulation stripping means other than jaw-like ones are also within the scope of the invention. For example,

funnel-like means could also be used for centering, and laser knives, disk-like knives rotating about their own axis or the like could also be used for cutting. The components described or shown in connection with Fig. 22, such as drives, guides, etc., can also be used in the subjects of Fig. 23-27, in a manner comprehensible to a person skilled in the art.

Although not stated in more detail, it is however clear to a person skilled in the art with regard to the various automatic insulation stripping machines launched on the market by Schleuniger AG since 1985 that preferably a control apparatus (27) with a data memory and a data input apparatus is provided, which control apparatus program-controls the relative length position of the cutting apparatus (030) with respect to the cable (107) and/or the multistage cutting depth of the knife. This also applies to the complete computer control of the drives of the other embodiments.

### List of reference symbols

This list is not applicable to Fig. 22.  
Excepted from this are the three-digit reference symbols with 1 at the beginning.

5	001	Brake disk
	002	Slip ring
	003	Cover
	004	Nut
10	005	Nut II
	006	Spindle
	007	Nut III
	008	Bearing flange
	009	Jaw cover
15	010	Knife guide
	111	Jaw guide
	012	Spiral flange
	013	Centering jaws
	014	Knife cover
20	015	Knife holder
	016	Wedge formation on rod 060
	017	Head flange
	018	Wedge clamp
	019	Nut flange
25	020	Gear wheel II
	021	Axle holder
	022	Jaw shaft
	023	Sliding bearing
	024	Gear wheel
30	025	Pressure spring
	026	Disk
	027	Reducing sleeve
	028	Handle
	029	Adjusting nut
35	030	Knife
	031	Sliding bearing
	032	Sliding bearing

	033	Sensor plate
	034	Ball sleeve KH
	035	Shim
	036	Threaded pin
5	037	Shim
	038	Countersunk bolt
	039	Countersunk bolt
	040	Sliding bearing
	041	Ball bearing
10	042	Bearing sleeve
	043	Screws
	044	Straight pin
	045	Screws
	046	Threaded pin
15	047	Screws
	048	Threaded pin
	049	O ring Di
	050	Straight pin
	051	Countersunk bolt
20	052	Screw
	053	Countersunk bolt
	054	Proximity switch
	055	Straight pins
	056	Screw
25	057	Rotating box
	058	Continuous cable processing machine
	060	Rod
30	061	Actuator
	A-G	Replaceable modules
	a-c	Knife variants
	1 a, b	Upper tool support
35	2 a, b	Lower tool support
	3 a, b, c, d, e, f, g, h	Upper and lower tools (knives or the like)

- 5 a, b, c Drives
- 9 Pivotal guide
- 9b Guide tube
- 10 a, b Cable feed unit
- 5 11 a-d Roller drive for continuous belt or directly for driving the cable
- 12 Continuous belt drive
- 13 Continuous belt, preferably toothed belt with engaging transport side
- 10 14 a, b Spindle for preadjustment of the belt drive 12
- 16 a, b Closing drives
- 17 Guide
- 18 Spindle for knife unit
- 15 24 Belt
- 25 Drive
- 26 Stepping motor or controlled drive
- 27 Linear guides
- 28
- 20 29 Pressure springs
- 30b Pivot member
- 31 Stop
- 32b Rubber buffer
- 32 Displacement magnet
- 25 33 Slide
- 34 Connecting rod
- 35 Bearing
- 40 a, b Displaceable guide sleeves
- 41 Shaft encoder, encoder
- 30 42 Inductive sensor or the like
- 43 a, b Holder
- 44 a, b Guide rods which support the holder 43
- 45 a, b Drives, in this case pneumatic but other drives also possible. They include a cylinder and guide.
- 35 46 Air blow-out orifice
- 47 Drive, stepping motor

	48	Toothed belt
	49	
	50	Drive roller retaining member
	51 a, b	Adjusting nut
5	52 a, b	Driver member
	57	Conductor
	100	First transport path
	101	Actuator, lever
10	102	2nd transport path
	103	2nd transport path
	105	
15	106	In the working position of the cable, the cable axis coincides with a transport path 100, 102, 103
	107	Cable, cable ends 107a, b
	109	
20	110	Linear guide, drive roller axis
	111	Rollers, pairs of rollers
	112	Transport means
	113	Transport means
25	115	Knife station a-1

### List of reference symbols for Fig. 22

In this Figure, only the three-digit reference symbols coincide with the reference symbols of the other list of reference symbols.

5	1	
	2, 3	
	4, 5	Belt (top, bottom)
	6	Roller
10	7	Roller frame
	8	Holding carriage
	9	Actuating element
	10	Rail
	10a	Guide profile
15	11	Stepping motor
	12	Drive wheel
	13	
	14	Deflecting roller
	15	
20	16, 17	Processing station
	16a	Insertion orifice
	18	
	19	Knife frame
	20	Movement elements
25	21	Centering guide
	22	Linear guide
	23	Adjusting drive

**Patent claims**

1. A continuous cable processing apparatus having a cable transport apparatus which comprises at least one first and at least one second transport means (A, B; C; 111; 112, 113) for linear transport and holding of a cable (107) along a first transport path (100) definable by the cable axis (106), having at least one knife station (E, F, G, 115) for processing the cable (107) along this transport path (100), the knife station (E, F, G, 115) being arranged between the two transport means (A, B; C; 111; 112, 113) and, before and after the processing of the cable (107), said transport means holding said cable or each holding one of the cable end regions (107a, b), facing one another and created by the knife station, so as to be movable parallel to the first transport path (100) in the longitudinal cable direction, wherein the knife station (E, F, G, 115) and/or at least one of the transport means (A, B; C; 111; 112, 113) is displaceable approximately at right angles or at right angles to the first transport path (100) by means of a motor.

2. The cable processing apparatus as claimed in claim 1, wherein the knife station (E, F, G, 115) for receiving a plurality of tools (3; 3a-h) is formed transversely with respect to the transport path (100) and is displaceable by means of a motor transversely with respect to the transport path (100) so that each tool (3; 3a-h) can be positioned in a working position along the transport path (100), at least two, optionally continuously positionable, holding apparatuses being provided for the tools (3; 3a-h), and the tools (3; 3a-h) being selectable as required from the group consisting of the cable-processing tools, for example, comprising: knives, crimping tools, twisting tools, punching tools, clamping apparatuses, marking apparatuses, grinding apparatuses, etc.

3. The apparatus as claimed in claim 1 or 2, wherein the transport means (A, B; C; 111; 112, 113) each have at least one pair of rollers (A, B; 111) and/or each have one pair of continuous belts (C; 112).

5 4. The apparatus as claimed in any of the preceding claims, in particular insulation stripping apparatus having at least one pair of tool supports (1, 2) for receiving at least two tools (3), and a tool support feed means (5) for positioning one or other tool (3a, b, c, d) above the first transport path (100) or above  
10 an axis (106) along which a cable (107) from which the insulation is to be stripped can be inserted in its feed direction, the tool support feed means (5) being formed for a controlled lateral drive for the controlled sideward displacement of at least one tool  
15 support (1, 2) to any desired positions within a working range to the side of the transport path (100) or of the axis (106).

5. The apparatus as claimed in claim 4, wherein the  
20 tools (3) are arranged in pairs and have at least two pairs of knives, for example at least one knife at the top and at least one knife at the bottom per pair.

6. The apparatus as claimed in any of the preceding claims, wherein both tool supports (1b, 2b; 1c, 2c) are  
25 held on a common support part (8) and are displaceable together therewith.

7. The apparatus as claimed in any of the preceding claims, wherein a separate tool support feed means (5a, b) is coordinated with each tool support (1, 2) so that  
30 upper and lower tool positions can be combined.

8. The apparatus as claimed in any of the preceding claims, wherein the tool holders (1, 2) - optionally also independently of one another - are continuously adjustable relative to one another or toward or away  
35 from the axis (106).

9. The apparatus as claimed in any of the preceding claims, wherein a guide apparatus (9) (pipe) which can

be swivelled laterally upward or downward is provided, which guide apparatus can be swivelled laterally or preferably upward for increasing the insulation stripping lengths, in order to enable a cable (107) already the other side of the tool (3) to be pushed back against the feed direction without collision.

10. The apparatus as claimed in any of the preceding apparatus claims, wherein the rollers (A, B; 111) or continuous belts (C; 112) located opposite one another across the axis 106 are - preferably continuously - adjustable relative to one another and in particular can be opened and closed in a cable-dependent and feed-controlled manner (so that, for example, a cable (107) arriving is received between opened rollers (A, B; 111) or belts (C; 112) and is transported onward by means of rollers (111) or belts (112) moved toward one another or closed) and/or can be held against one another under a - preferably variable or controllable - contact pressure.

11. The apparatus as claimed in any of the preceding apparatus claims, wherein, in the case of a continuous belt pair (C; 112), the continuous belts (13) are each guided around at least two rollers (111), between which, in the middle region, preferably at least one support roller (14) is arranged for supporting the belt (13), and/or wherein the belts (13) are in the form of a toothed belt on the inside and/or are slip-resistant on the outside.

12. The apparatus as claimed in any of the preceding apparatus claims, wherein the pairs of continuous belts (112) or the rollers (111) or at least one of the belts (13) of the pairs (112) can be removed without replacement and/or can be replaced by, preferably, coated drive rollers (111) or pairs (112) of continuous belts, or the continuous belt pair module (C) can be replaced by roller modules (A, B), and vice versa.

13. The apparatus as claimed in any of the preceding

apparatus claims, wherein at least the upper and/or the lower rollers (111) or continuous belts (112) of a pair of rollers or of a pair of continuous belts, respectively, and/or the upper and lower tool holders (1) are each displaceable transversely with respect to the transport path (100), relative to the opposite part in each case, so that a twisting procedure can be performed on a cable (107) lying in between.

14. The apparatus as claimed in any of the preceding claims, wherein the tool support feed means (5) comprises at least one motor, for example a stepping motor (23), in particular a linear stepping motor, and a programmable microprocessor for the control thereof and/or a cable absence sensor, and/or wherein a plurality of tool support feed means (5) having a plurality of tool supports (1, 2) are arranged along the axis (106).

15. The cable processing apparatus having a drive for a pair of rollers or of belts, as claimed in any of the preceding claims, wherein the rollers (111) or belts (13) opposite one another and belonging to pairs of rollers or of belts (A, B; 111; C; 112) are adjustable relative to one another by means of stepping motors - preferably via spindles, a control having an automatic RESET and/or a programmable circuit and/or at least one pressure sensor for measuring and/or evaluating the contact pressure on the cable (107) being coordinated with the motors.

16. The cable processing apparatus having drive and processing stations, as claimed in any of the preceding claims, wherein a common baseplate is provided, on which drive or feed or tool holders and/or measuring or marking modules can be provided in a mountable or removable or interchangeable manner at predetermined positions along the axis (106).

17. The cable processing apparatus having a roller feed or belt feed, as claimed in any of the preceding

claims, wherein an automatic threading apparatus and/or a measuring apparatus for the tensile load on the cable (107) and/or a dynamic contact pressure means on the feed rollers (111) or feed belts (112), in particular  
5 as a function of the tensile load on the cable (107), and/or a cable straightening apparatus and/or a length sensor are furthermore coordinated with the roller feed or belt feed.

18. The cable processing apparatus having a tool  
10 support for tool feed, as claimed in any of the preceding claims, wherein an encoder (41) is arranged on an adjusting spindle (18) of the tool support for the tool feed, which encoder, in the operating state, as a function of the drive movement of a drive motor  
15 (23; 16) - optionally by comparison with the comparable encoder value on the encoder of this drive (23; 16) - monitors the rotary movement of this adjusting spindle (18) in order to detect completed closing of the tools (3) and to stop the drive movement and to calibrate or  
20 to initialize the drive or its encoder, the connection between drive motor (23; 16) and spindle (14) preferably being elastic - in particular coupled via a toothed belt (24). (Fig. 7)

19. A process for operating a cable processing  
25 apparatus having tool holders and insertable tools, in particular as claimed in any of the preceding claims, wherein a monitoring member is provided which monitors the open state of the tool holders (1) or of the tools and reduces the drive force of the drive motor (23; 16)  
30 shortly before the closing of the latter, so that it brings the tool holder into the closed position with slight force, said position optionally being detected by virtue of the fact that an encoder connected to or integrated with the drive motor (23; 16) loses its  
35 steps (of the rotary movement) in spite of the supply of drive energy.

20. The apparatus as claimed in any of claims 1-18,

wherein a control member having a computer is provided, which, in the operating state, after input of the cable diameter and optionally a cable type designation and the desired insulation stripping length, automatically  
5 calculates and sets an initial opening of the roller or belt drive (A, B; 111; C; 112) and/or a contact pressure for stripping of long insulation sections or appropriately controls the drives.

21. The cable processing apparatus having a first  
10 and a second belt drive for a cable feed, as claimed in any of the preceding claims 1-18 or 20, wherein a gripping apparatus is coordinated with the second belt drive (112b), if required the second belt drive (112b) releasing the cable (107) so that it can be removed by  
15 the gripping apparatus.

22. The process for controlling a cable processing apparatus, in particular an apparatus as claimed in any of the preceding claims 1-18 or 20-21 having a program containing a control for controlling the drives of the  
20 apparatus, the program comprising program steps coordinated with individual process steps, wherein a plurality of such program steps are combined to form groups of operations, in which the step sequence is predetermined but the control parameters of at least  
25 one step are selectable or adjustable, the groups of operations, when called up, triggering program steps which are preprogrammed in such a manner and result in the control of the drives in the step sequence.

23. The process as claimed in claim 22, wherein the  
30 individual program or process steps or the control parameters linked therewith can be set to 0 or can be set by desired other parameters via an input unit - preferably under menu control.

24. The process as claimed in either of claims 22-  
35 23, wherein a plurality of program groups are combined to form overlapping program groups, and/or wherein the individual program groups are shown as an overview and

subsequently in detail on the display, the display permitting in particular interactive correction of the given values in the individual program steps.

25. The cable processing apparatus as claimed in any  
5 of the preceding apparatus claims, in particular as  
claimed in any of claims 1 to 6, wherein the  
displaceability of the one or more, preferably two,  
transport means (A, B; 112; C; 113) permits the  
parallel displacement of the cable (107) or of at least  
10 one cable end (107a, b) from the first transport path  
(100) to at least the second transport path (102, 103),  
and wherein a further processing station (16, 17) (for  
example an external device) is or can be coordinated  
with the second transport path (102, 103).

15 26. The apparatus as claimed in claim 25, wherein  
the further processing station comprises at least one  
transport or processing station (16, 17), such as, for  
example, an insulation stripping station, a sawing  
station, a cutting station, a twisting station, a  
20 shaping station, a crimping station or a soldering  
station, a cable end processing station or a  
manipulator arm or the like.

27. The apparatus as claimed in claim 25 or 26,  
wherein at least one transport means (A, B; 111; C;  
25 112, 113), but preferably one each on both sides of the  
knife station (E, F, G, 115), is guided in a linear  
guide (110) transversely to the transport path (100)  
and in particular can be moved by a drive apparatus  
(111-14), preferably a stepping motor.

30 28. The apparatus as claimed in any of claims 25 to  
27, wherein the drive apparatus (111-14) of each  
movable transport means (111; 112, 113) and at least  
one independent transport drive, but preferably one  
each on both sides of the knife station (E, F, G, 115),  
35 is connected to a common control which preferably also  
controls the knife station (E, F, G, 115) and the one  
or more further processing stations (16, 17), so that

all longitudinal and transverse movements can be performed in a coordinated and time-optimized manner, in particular in synchronization with the processing steps.

5 29. The apparatus as claimed in any of the preceding apparatus claims, wherein the two transport means (112) are connected to one another by a common motor-controlled actuator (101) so that, preferably, the transverse adjustment of one transport means (112a)  
10 inevitably results in a diametrically opposite lateral adjustment of the other transport means (112b). (Fig. 23, 25, 26)

30. The apparatus as claimed in any of the preceding claims 1-28, wherein at least one transport means  
15 (112a) is connected to the knife station (115) or to at least one tool support by a common, motor-controlled actuator (104) so that, preferably, the transverse adjustment of one transport means (112b) inevitably results in a diametrically opposite transverse  
20 adjustment of the knife station (115) or of the tool support. (Fig. 24)

31. The apparatus as claimed in any of the preceding claims, wherein the knife station comprises a rotatable knife, or wherein a second knife station having a  
25 rotatable knife (030), whose axis of rotation is along the transport path or along one of the transport paths (100, 102, 103), is provided in addition to the knife station.

32. A process for stripping the insulation of a  
30 cable (107) by means of an apparatus as claimed in any of the preceding claims, in particular as claimed in claim 31, wherein the cable (107) is held (clamped) in a centered manner on at least two sides, preferably both sides of the knife (030), during the incision with  
35 the knife (030), at least one holding or clamping point being arranged in the immediate vicinity of the knife (030), the knife feed being coupled with the feed for

the clamping and/or centering apparatus or the clamping feed being separate from the knife feed, and at least one transport means - preferably both transport means - or a clamping and/or centering apparatus being held nonrotationally or the clamping and/or centering apparatus (111; 112) closest to the knife rotating together with the latter.

33. The apparatus as claimed in any of the preceding apparatus claims, wherein the clamping and/or centering apparatus (A, B; 111, C; 112; 013) comprises at least two - preferably four clamping and/or centering jaws (111; 112; 013) which lie in a plane and each have a retaining surface, which retaining surfaces are at least approximately perpendicular to the radial plane with the cable (107) and are formed in such a way that closing of the jaws (A, B; 111; C; 112; 013) to approximately zero cable diameter is possible.

34. The insulation stripping apparatus as claimed in either of claims 33 and 34, wherein the cutting apparatus comprises two knife jaws (030) which lie in a plane and each have a cutting edge, which cutting edges are formed at least approximately parallel to one tangential plane each of the cable (107) and can be closed to zero and can be advanced to give different initial contact points at the edge with the cable sheath, depending on the cable diameter.

35. The apparatus as claimed in any of the preceding apparatus claims, wherein the knife station, in particular the cutting apparatus and at least one centering closing apparatus (A, B; 111, C; 112, 013) are in the form of an automatic processing module (rotating box) (057) which is removably mounted on a continuous cable processing machine (058), the module (057) preferably being connected to the frame of the continuous cable processing machine (058) by means of a hinge (059) so that it can be swivelled out of an axial working position - relative to the cable (107) - into a

mounting position inclined relative thereto.

36. The apparatus as claimed in any of the preceding apparatus claims, wherein the centering jaws (013) are L-shaped in section so that their retaining surfaces  
5 cover a relatively large axial range of a cable sheath and their ends project directly adjacent to the knife (030).

37. The apparatus as claimed in any of the preceding apparatus claims, wherein, for controlling the  
10 rotatable knives (030) along the transport path (100), displaceable rods (060) are provided which have, in the region of the knife holders (015), wedge surfaces (016) which cooperate with diametrically opposite formations of the knife holder (015), the rods (060) coming into  
15 contact at the other hand with a wedge clamp (018) which is displaceable along the transport path (100) by nonrotatable actuators (061).

38. The apparatus as claimed in any of the preceding apparatus claims, wherein a length meter in the form of  
20 an approximately force-free or contactless direct or indirect, for example mechanical or optical, sensor is provided for scanning the cable surface, which length meter optionally measures parallel to step measurements in the drives of the transport means so that each  
25 length measurement is quality-controlled.

**Abstract**

A continuous cable processing apparatus for producing cable sections (107a, b) with processed ends comprises a cable transport apparatus having at least one transport means (A, B; C; 111; 112, 113) for moving and holding the cable (107) in the axial direction and, transversely thereto, a knife station (E, F, G, 115). According to a special variant, two transport means (A, B; C; 111; 112, 113) are arranged in the longitudinal cable direction on both sides of the knife station (E, F, G, 115) and, after the cable (107) has been cut through, each hold one of the cable end regions (107a, b) produced on cutting, so that said end regions are movable in the longitudinal cable direction. At least one of these end processing stations (16, 17) is arranged transversely with respect to the longitudinal cable direction, adjacent to the knife station (E, F, G, 115) and at least one transport means (A, B; C; 111; 112, 113) is movable transversely with respect to the longitudinal cable direction so that a cable end region can be fed to the end processing station (16, 17).

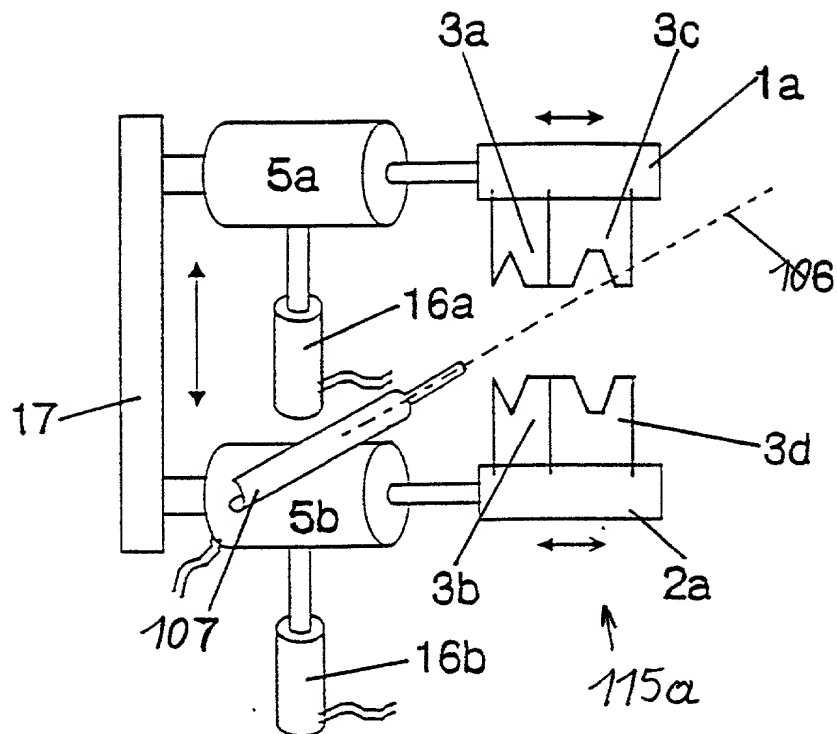
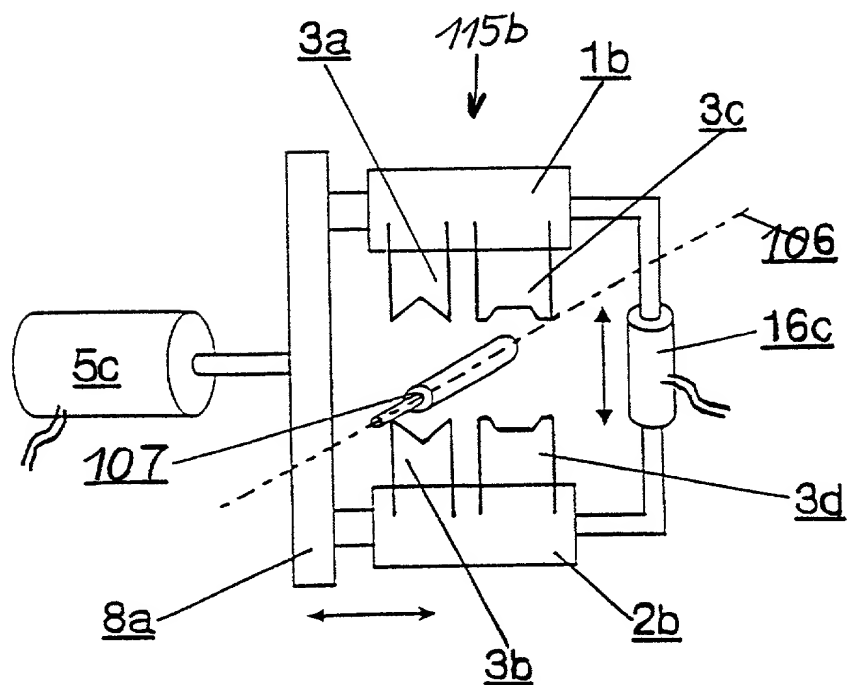
(Fig. 25)

List of Figure captions

1. Modules for CS 9150
2. Roller arrangement
3. Modules for CS 9150
4. Belt arrangement
5. Knife unit CS 9150
6. Not limited
7. 2 knife positions
8. 3 knife positions
9. V-blade
10. Radial blade
11. Radial blade with shoulder
12. Die blade
13. Slit blade
14. Parting blade
15. Shallow blade
16. Shallow blade, U-shaped
17. Shallow blade, contoured
18. Shallow blade with shoulder
19. Special shallow blade
20. - Left drive module with drive belt  
- Pivotal guide unit
21. - Blade module  
- Module for Y axis displacement  
- Right drive module with drive belt
22. - Left drive module with drive belt  
- Pivotal guide unit
23. - Blade module  
- Module for Y axis displacement  
- Right drive module with transport rollers
24. Insulation stripping length, right, greater than  
50 mm
25. 1 terminating  
2 Coax slit  
3 Coax steps  
4 Cutter strip

- 5 Cutter slit
- 6 Cutter steps
- 26. For item 3
- 27. Terminating
- 28. Coax slit
- 29. Coax steps
- 30. Cutter strip
- 31. Cutting slit
- 32. Cutter strips
- 33. End 1: terminating:
- 34. Stopping
- 35. Marking
- 36. Coax slit
- 37. Cutter slit
- 38. End 2: coax slit:
- 39. Recommended operations:
- 40. End 3: coax step:
- 41. Recommended operations (extracts):
- 42. End 4: cutter strip:
- 43. Recommended operations:
- 44. End 5: cutter slit:  
See under coax slit
- 45. End 6: cutter step:  
See under coax strips
- 46. Middle part 1: stopping:
- 47. Basic operation:
- 48. Middle part 1: marking:
- 49. Basic operation:
- 50. Further operations:
- 51. Middle part 3: coax window:
- 52. Recommended operations:
- 53. Position for knife change

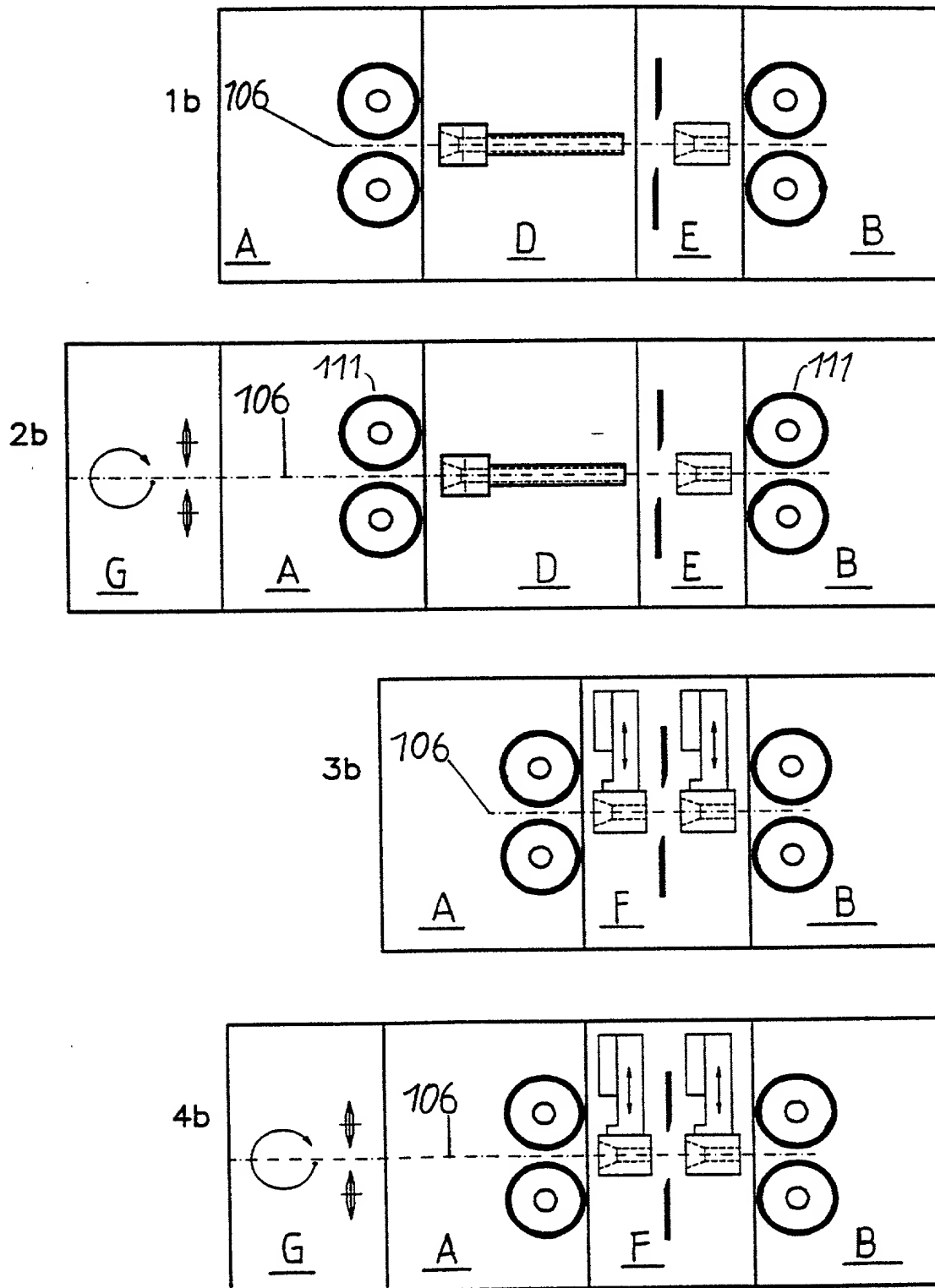
1/33

**Fig. 1****Fig. 2**

Module zu CS9150

**Fig. 3**

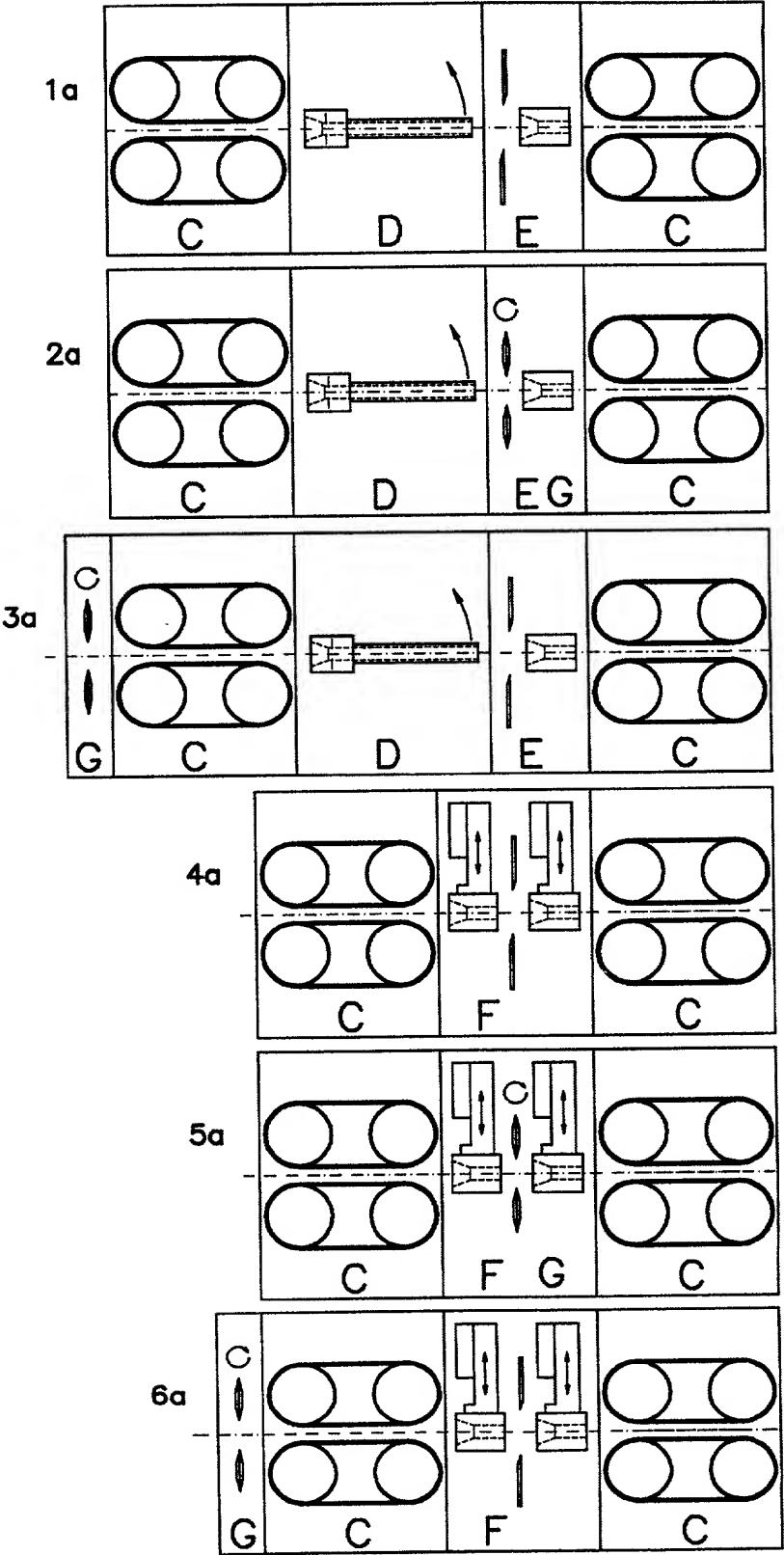
Rollenausführung



Module zu CS9150

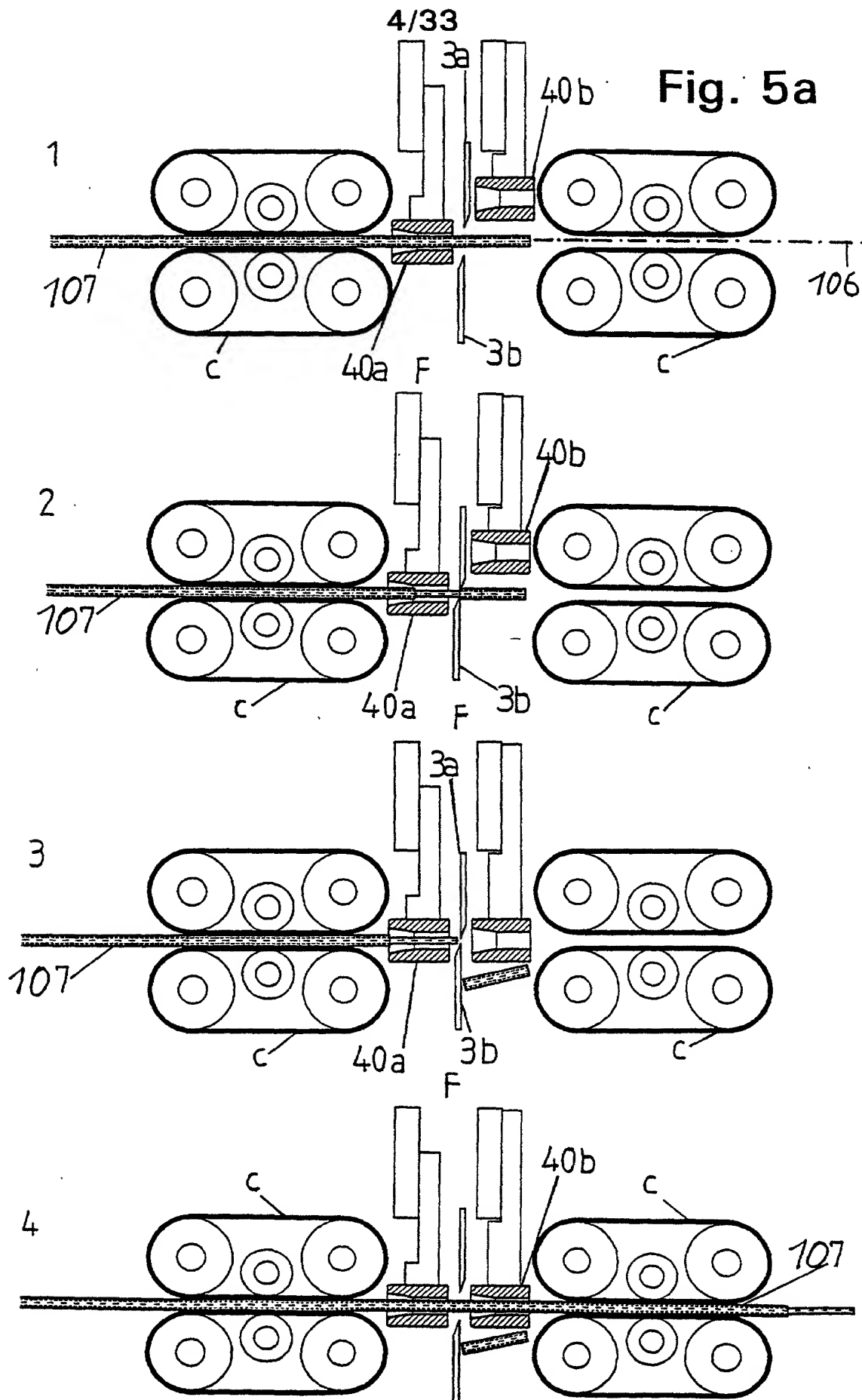
Fig. 4

Bandausführung



4/33

Fig. 5a



5/33

Fig. 5b

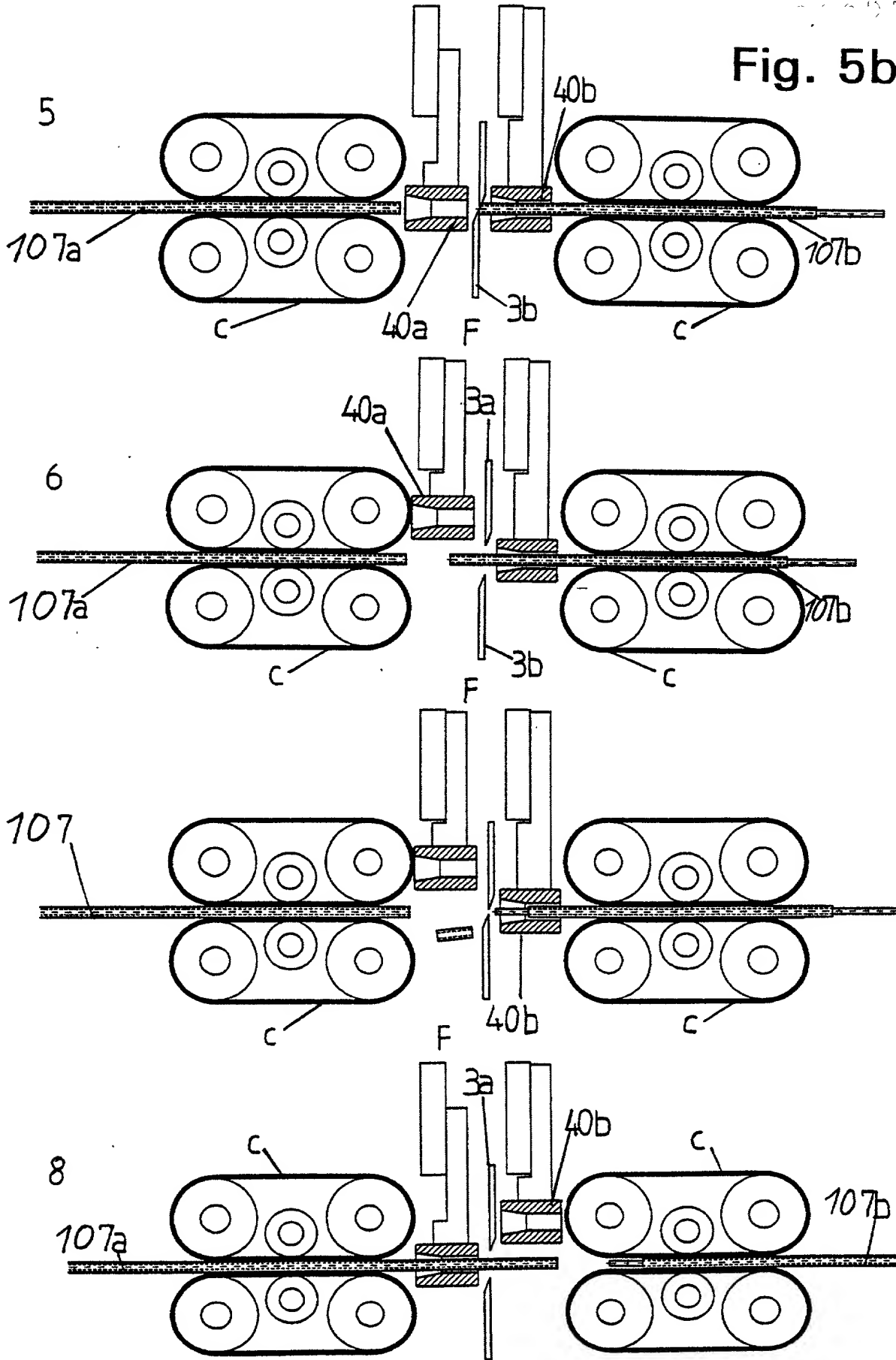
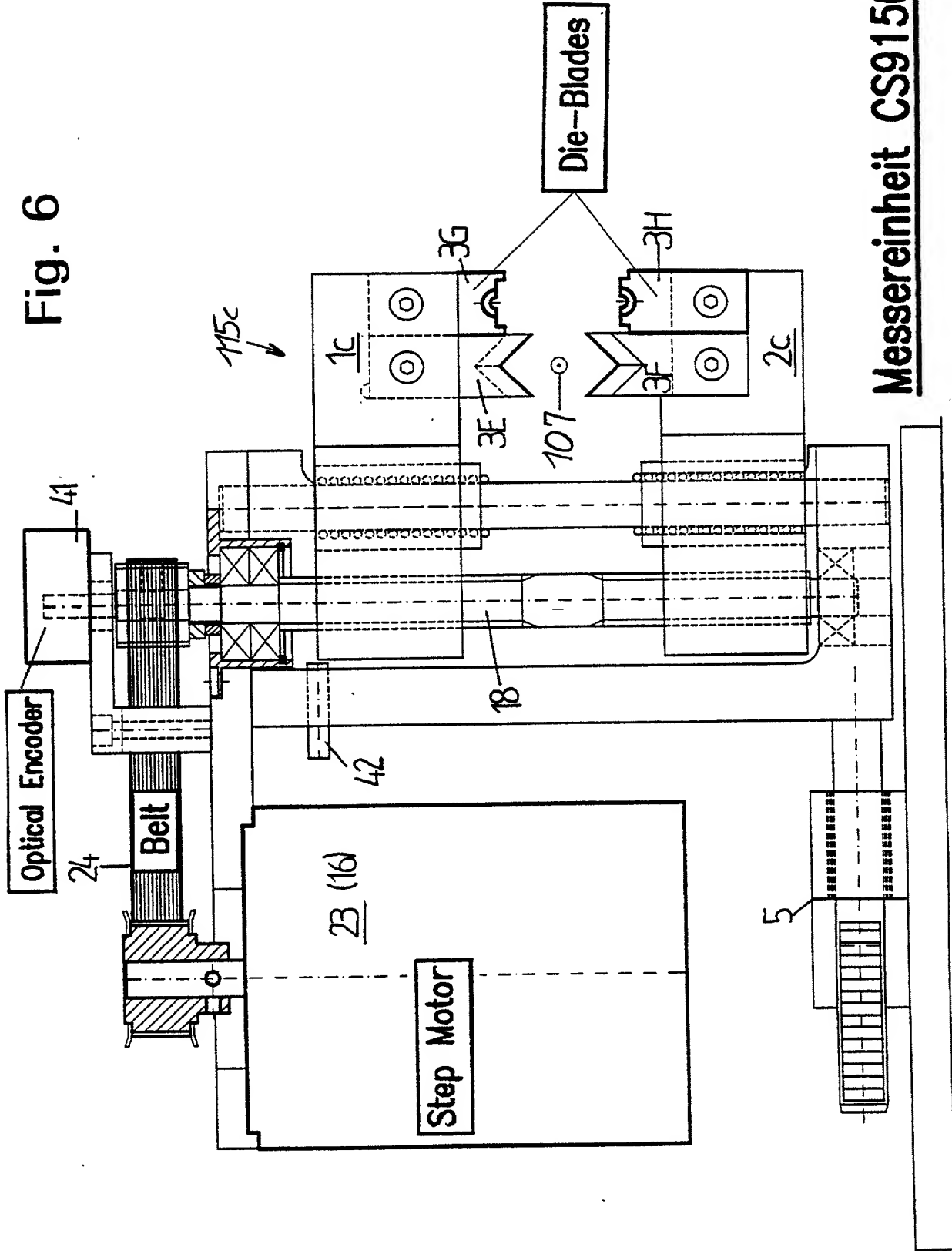


Fig. 6



Messereinheit CS9150

Fig. 7

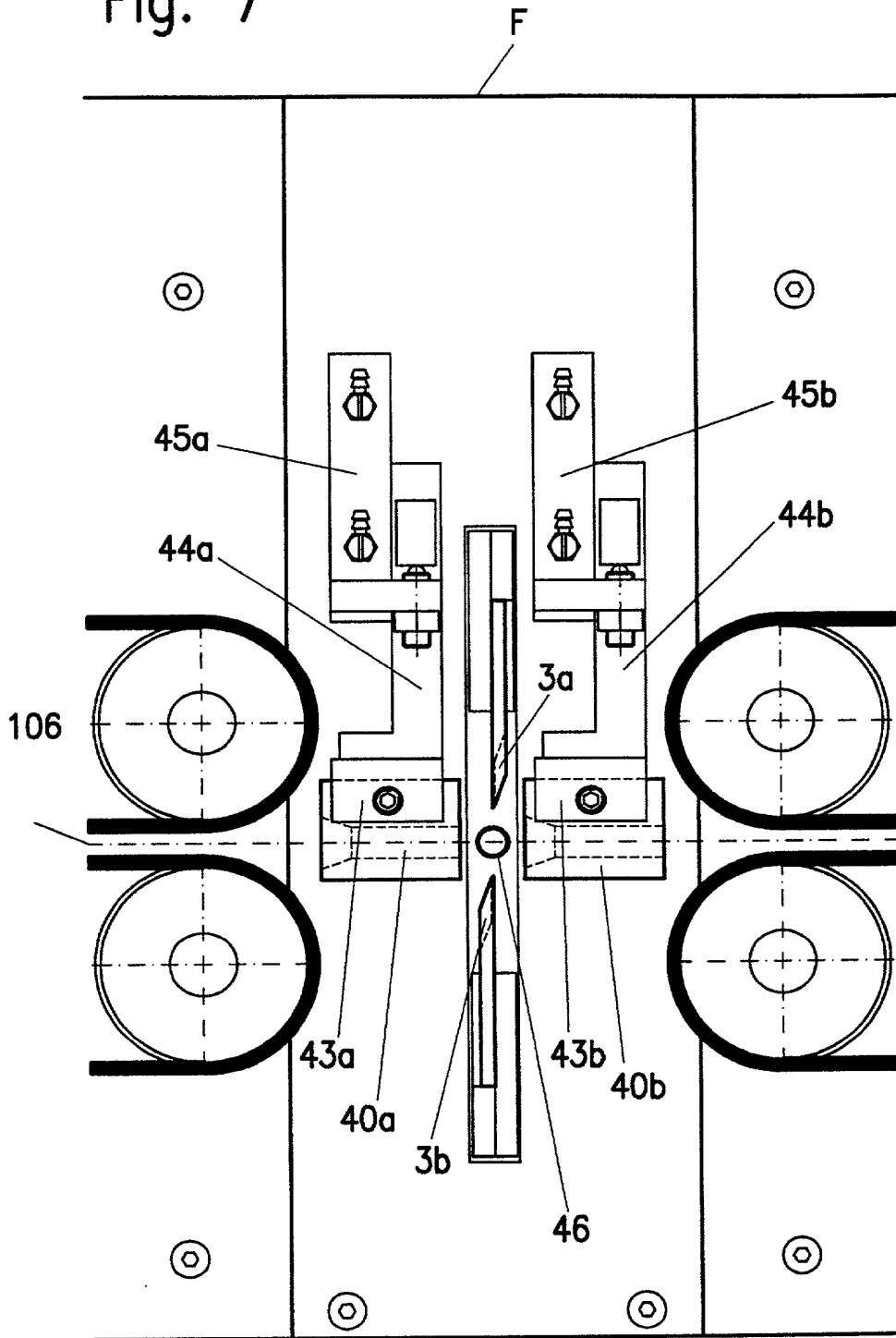


Fig. 8

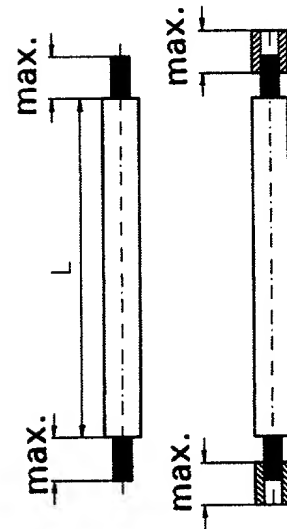
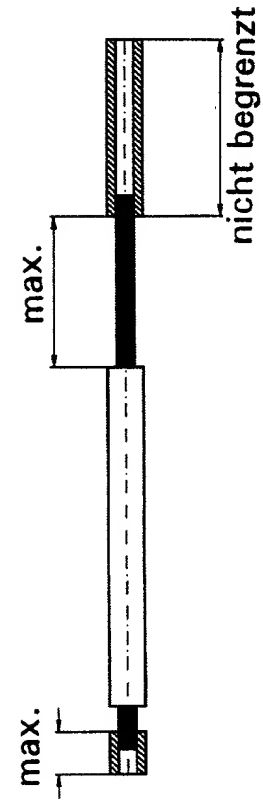
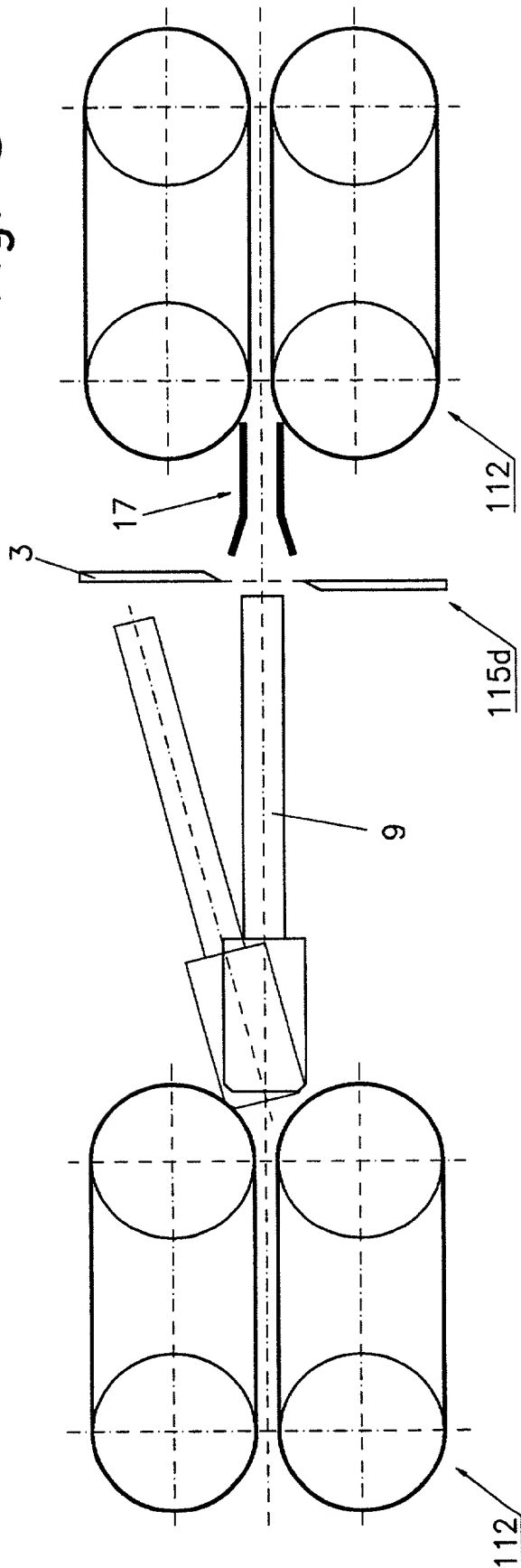


Fig. 9

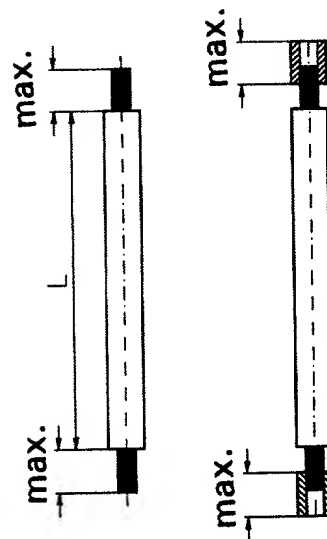
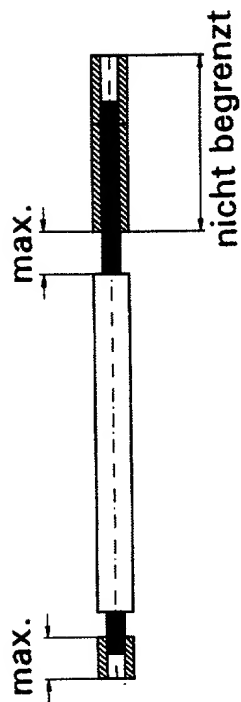
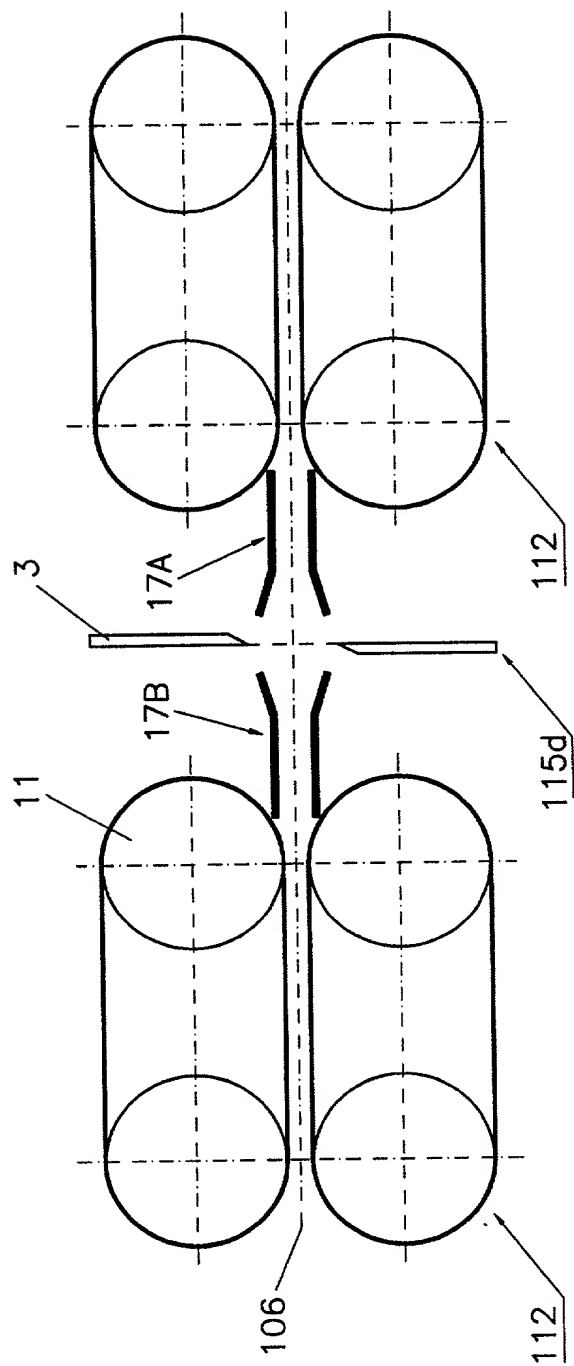


Fig. 10

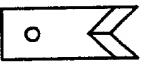
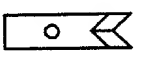
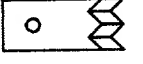
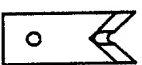
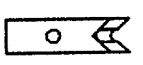



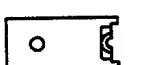
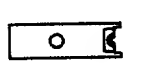
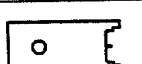
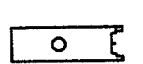
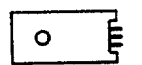
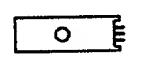
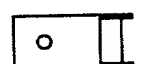
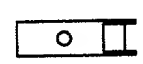

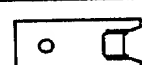
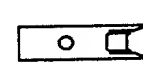
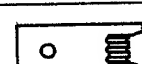
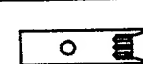
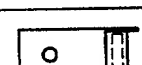
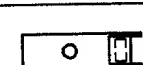
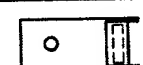
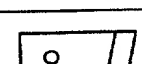
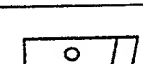
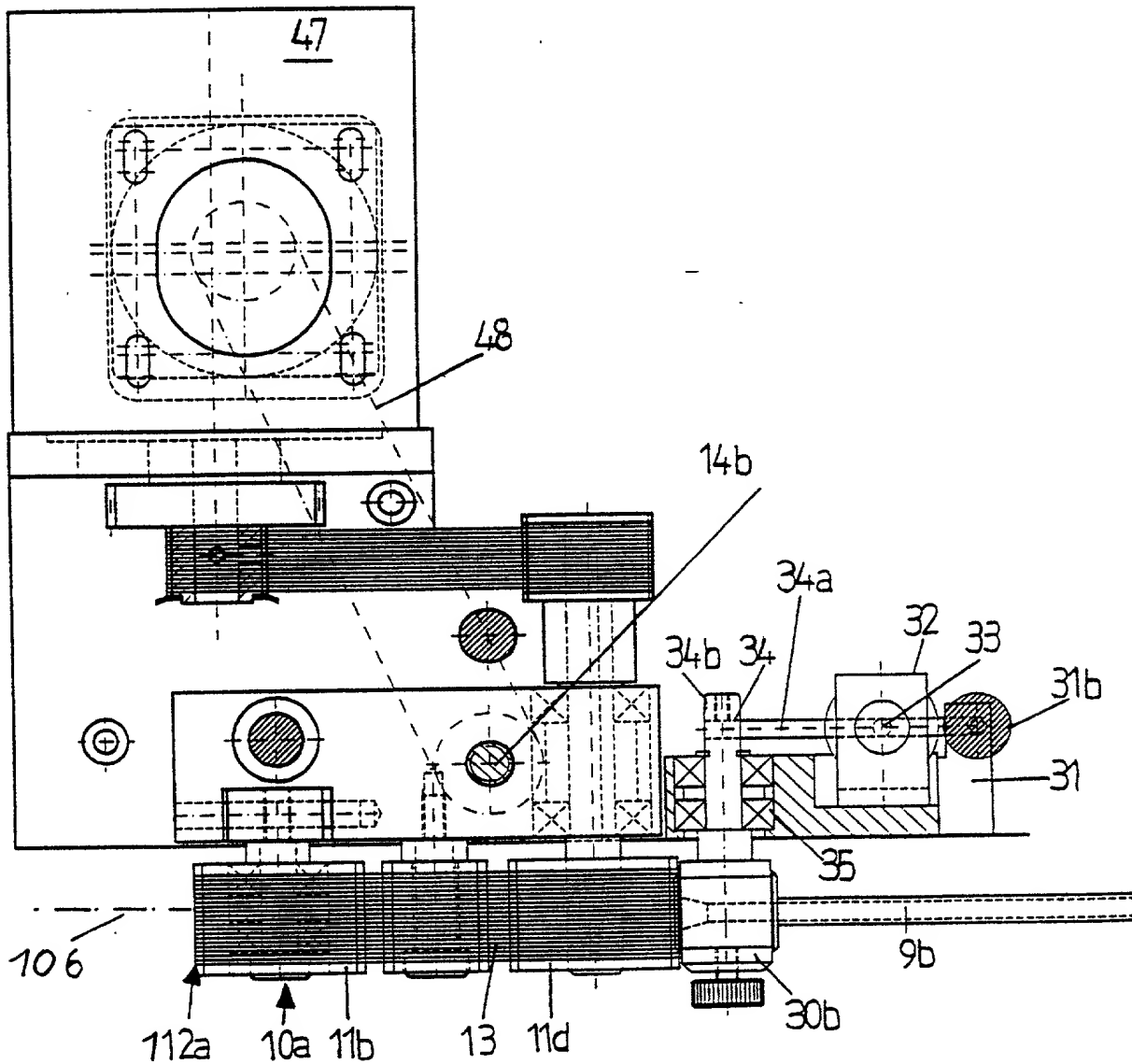
2 Messerpositionen single wire processing	3 Messerpositionen single wire processing	2 Messerpositionen dual wire processing	
		a) 	V-Messer
		a) 	Radius Messer
			Radius Messer mit Schulter
			Formmesser
			Schlitzmesser
c) 	c) 		Trennmesser
b1) 	b1) 	b1) 	Flachmesser
			Flachmesser U-Form
b) 	b) 		Flachmesser Kontur
			Flachmesser mit Schulter
			Flachmesser spez.

Fig. 11

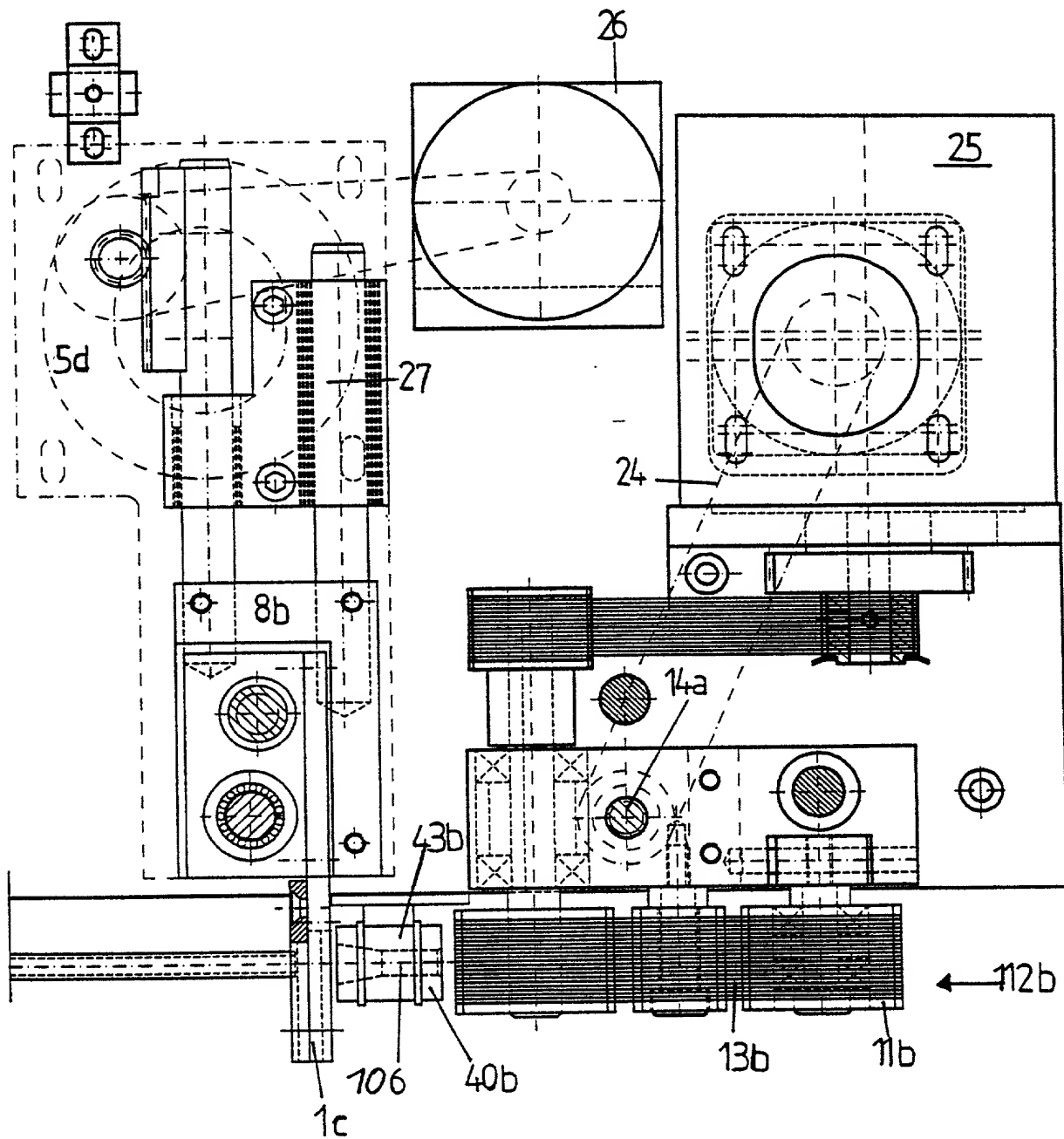
-Antriebsmodul links mit Antriebsriemen  
-schwenkbare Führungseinheit



12/33

Fig. 12

- Schneidemodul
- Modul Y-Achse Verschiebung
- Antriebsmodul rechts mit Antriebsriemen



13/33

Fig. 13

-Antriebsmodul links mit Antriebsriemen  
-schwenkbare Führungseinheit

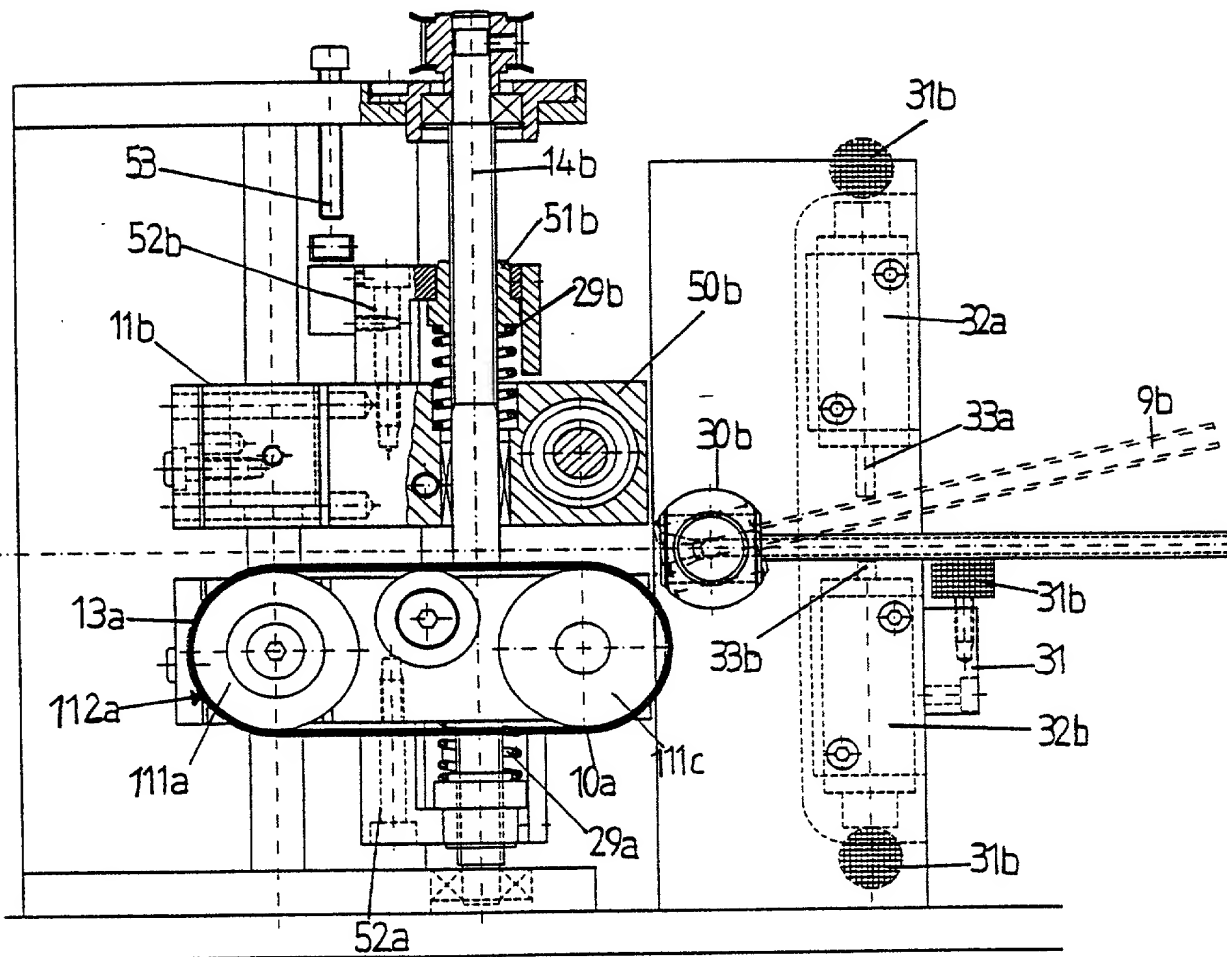
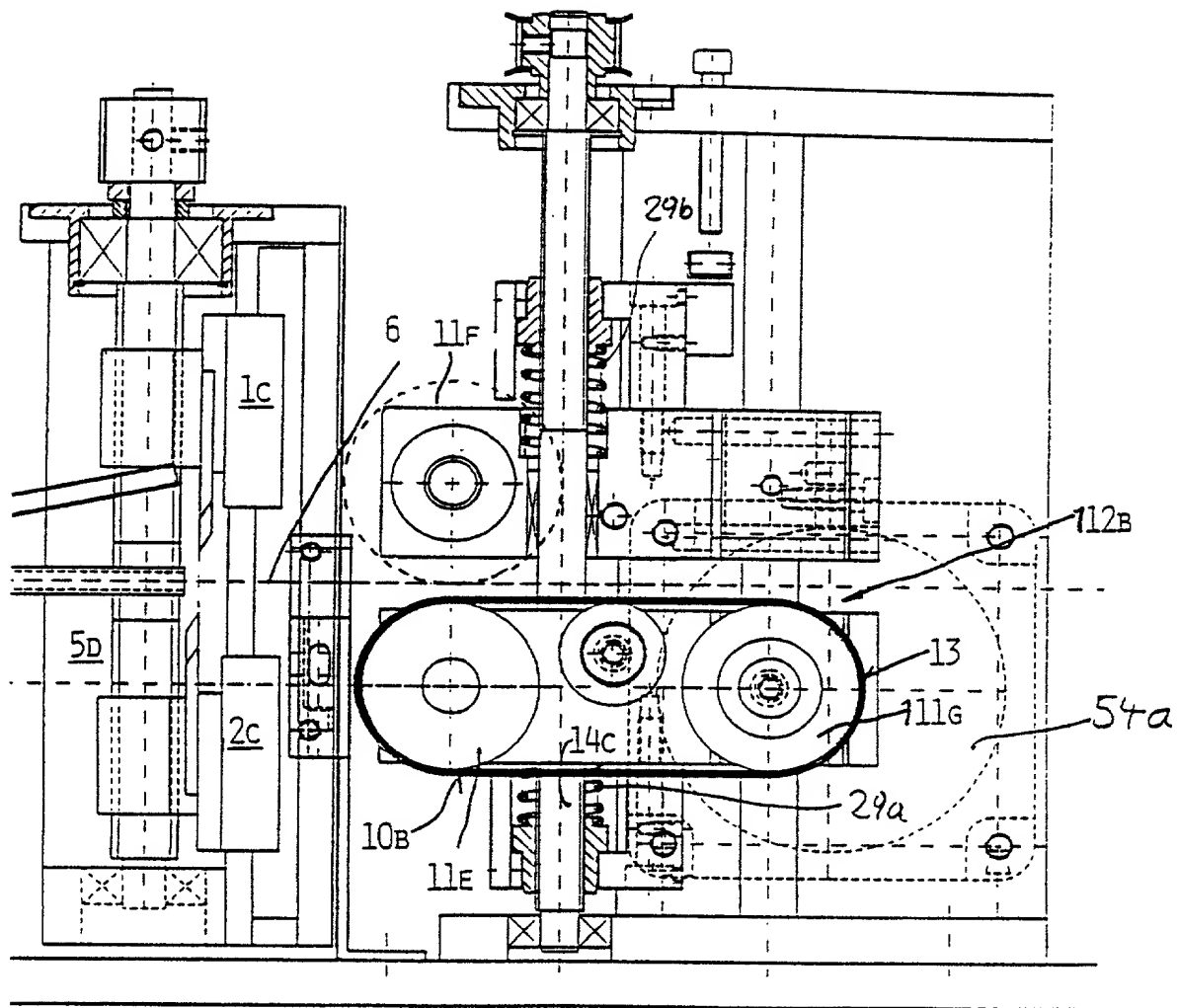


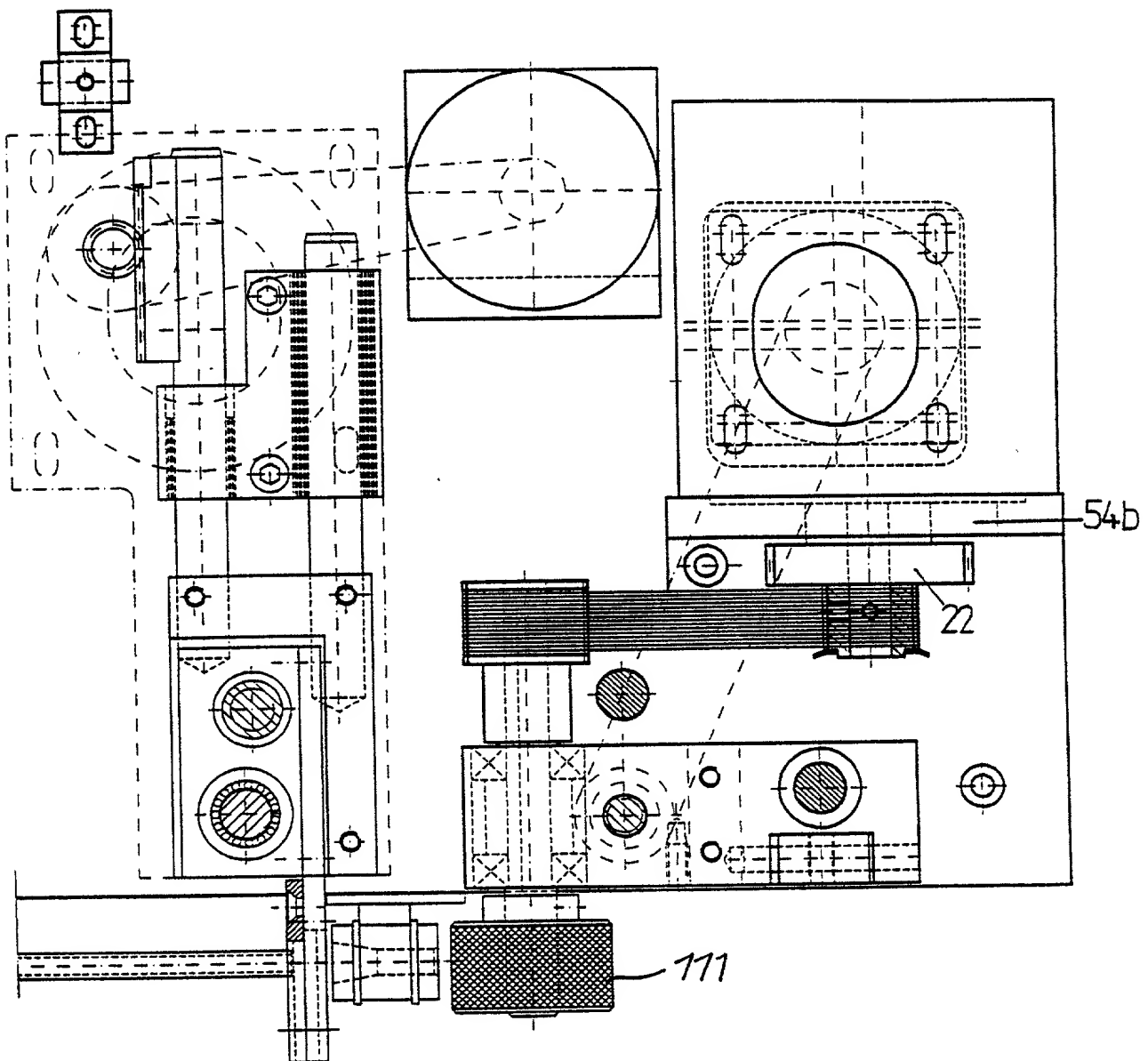
Fig. 14



15/33

Fig. 15

- Schneidemodul
- Modul Y-Achse Verschiebung
- Antriebsmodul rechts mit Transportrollen



16/33

Fig. 16

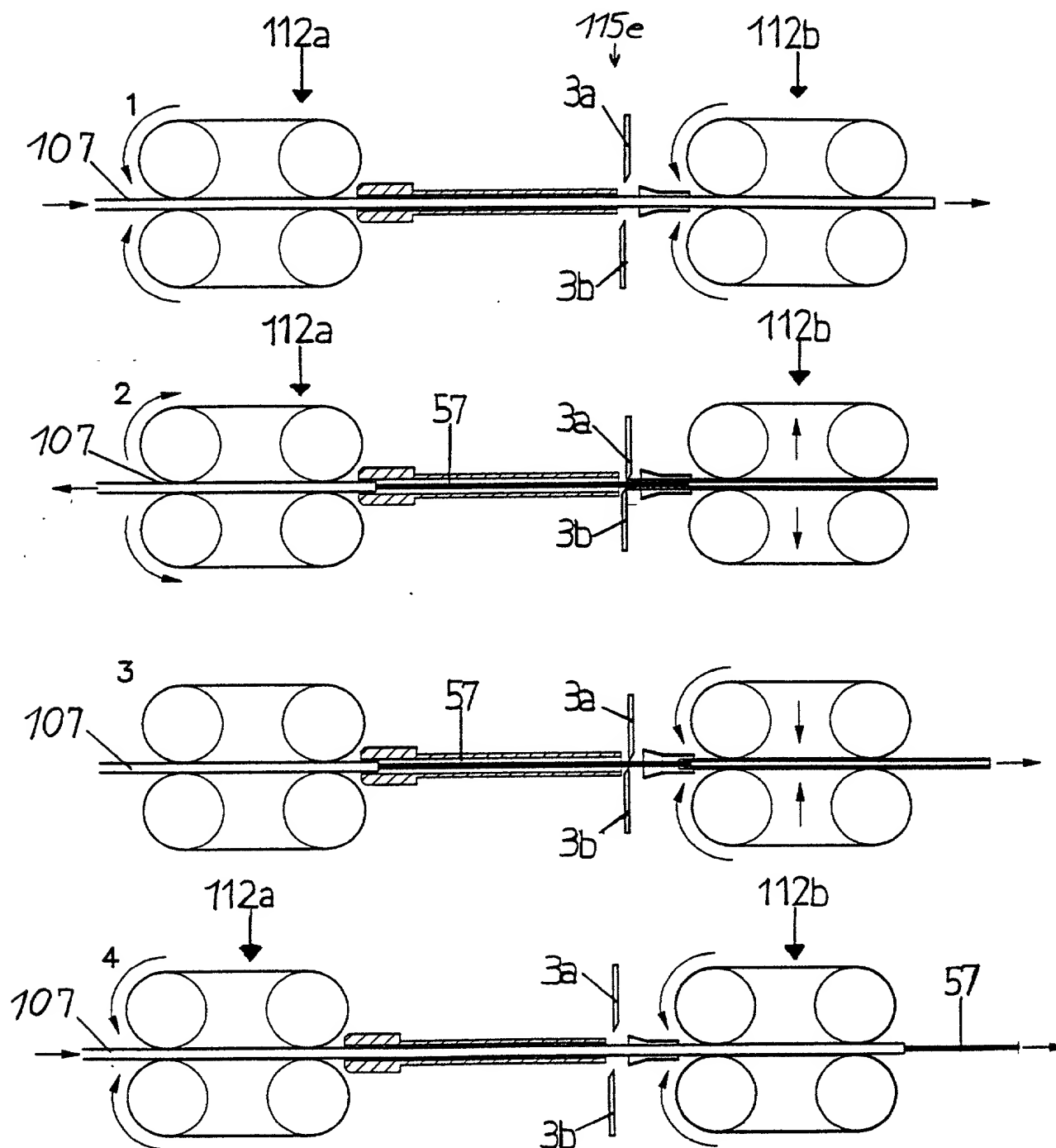
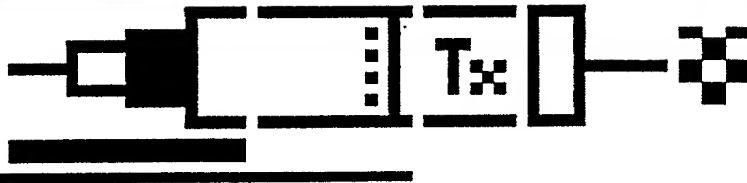
Abisolierlänge rechts grösser als 50mm

Fig. 17

# Operations Screen

Operations: Unnamed



- |                  |                    |
|------------------|--------------------|
| 1 Terminating    | 4 Cutter Abzug     |
| 2 Coax Schlitzen | 5 Cutter Schlitzen |
| 3 Coax Stufen    | 6 Cutter Stufen    |

Exit Sort Edit Paste Cut Exit

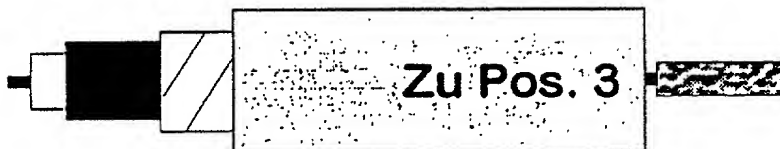
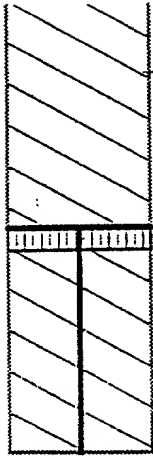


Fig. 18 1/2

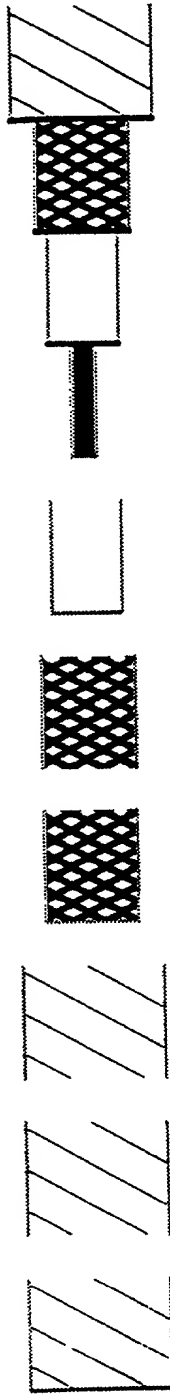


1 Terminating.

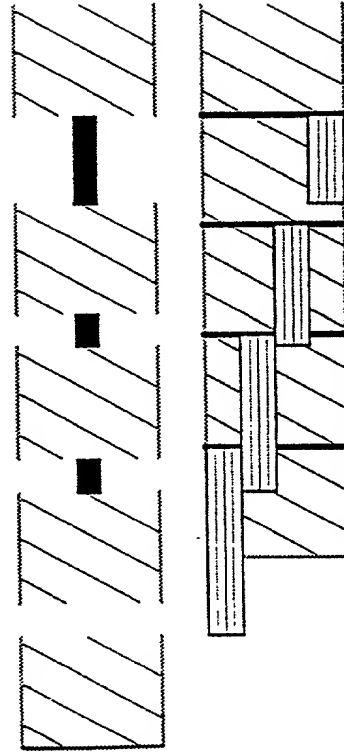


2 Koax Schlitz.

18/33

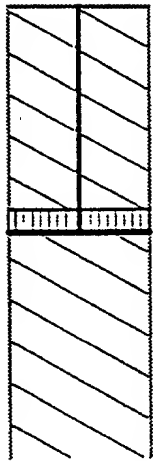


3 Koax Stufen.



4 Cutter Abzug

Fig. 18 2/2



5 Cutter Schlitz.

6 Cutter Stufen.

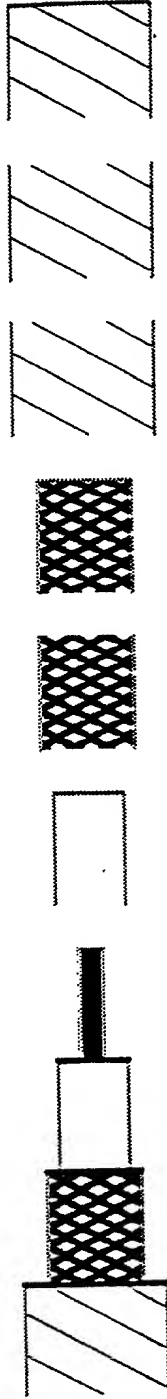


Fig. 20a

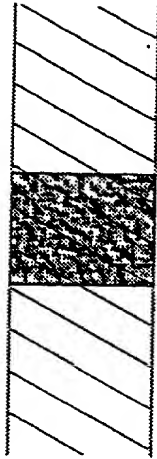
Ende 1: Terminating:  
SPEWIR04.DS4



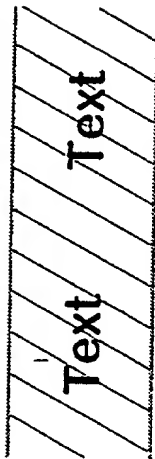
Fig. 19

20/33

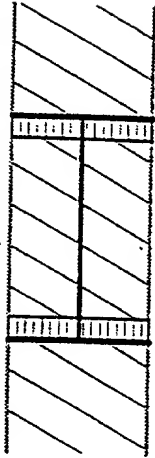
1 Stopping.



2 Marking.



3 Koax Schlitz.



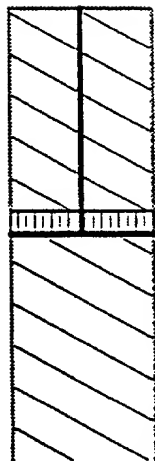
4 Cutter Schlitz.



Fig. 20b

**Ende 2: Koax Schlitz:**

SPEWIR05.DS4, SPEWIR06.DS4, SPEWIR07.DS4



Empfohlene Operationen:

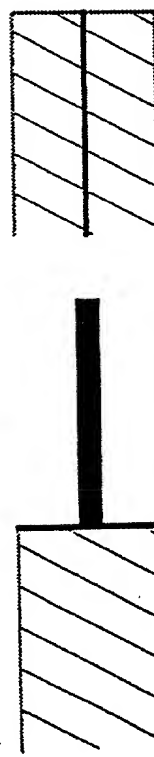
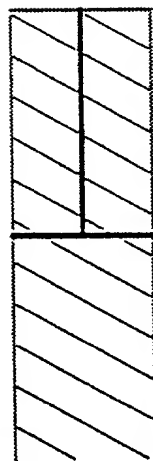
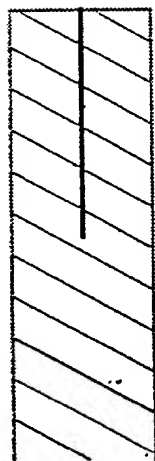
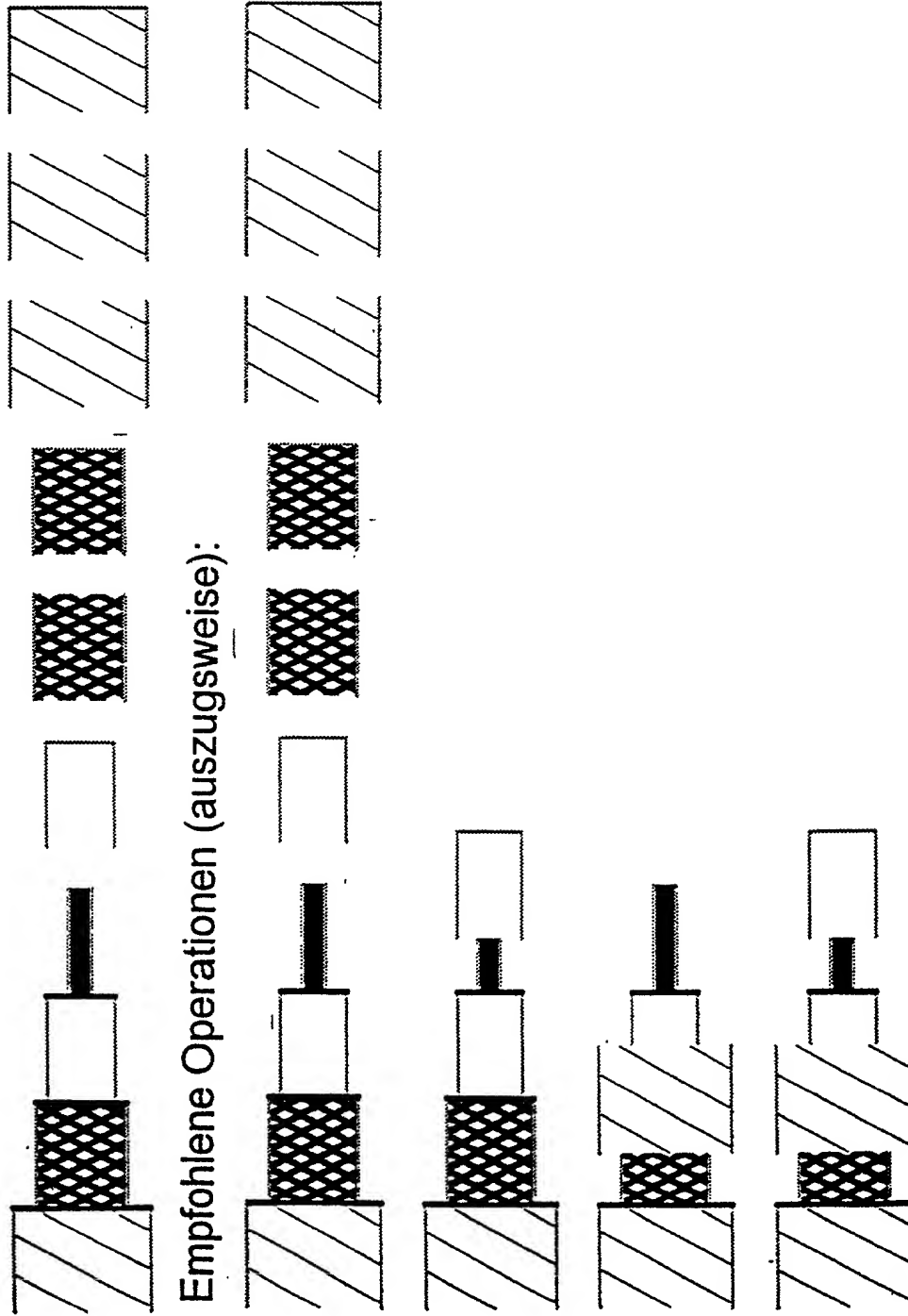
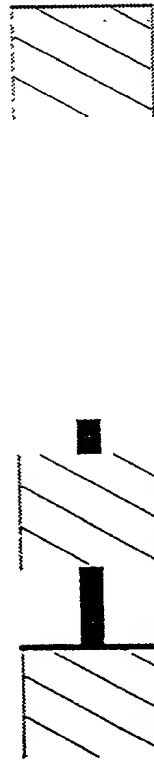
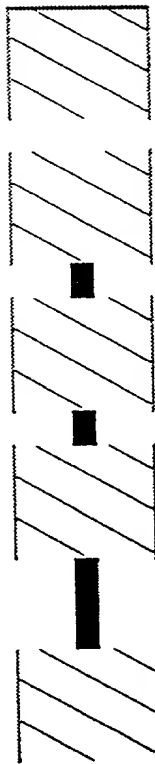


Fig. 20c

Ende 3: Koax Stufe:  
SPEWIR08.DS4, SPEWIR09.DS4



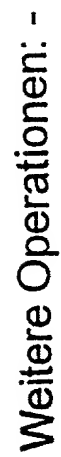
[illegible]

**Ende 6: Cutter Stufen:**  
s. unter Koax Stufen

Grundoperation:

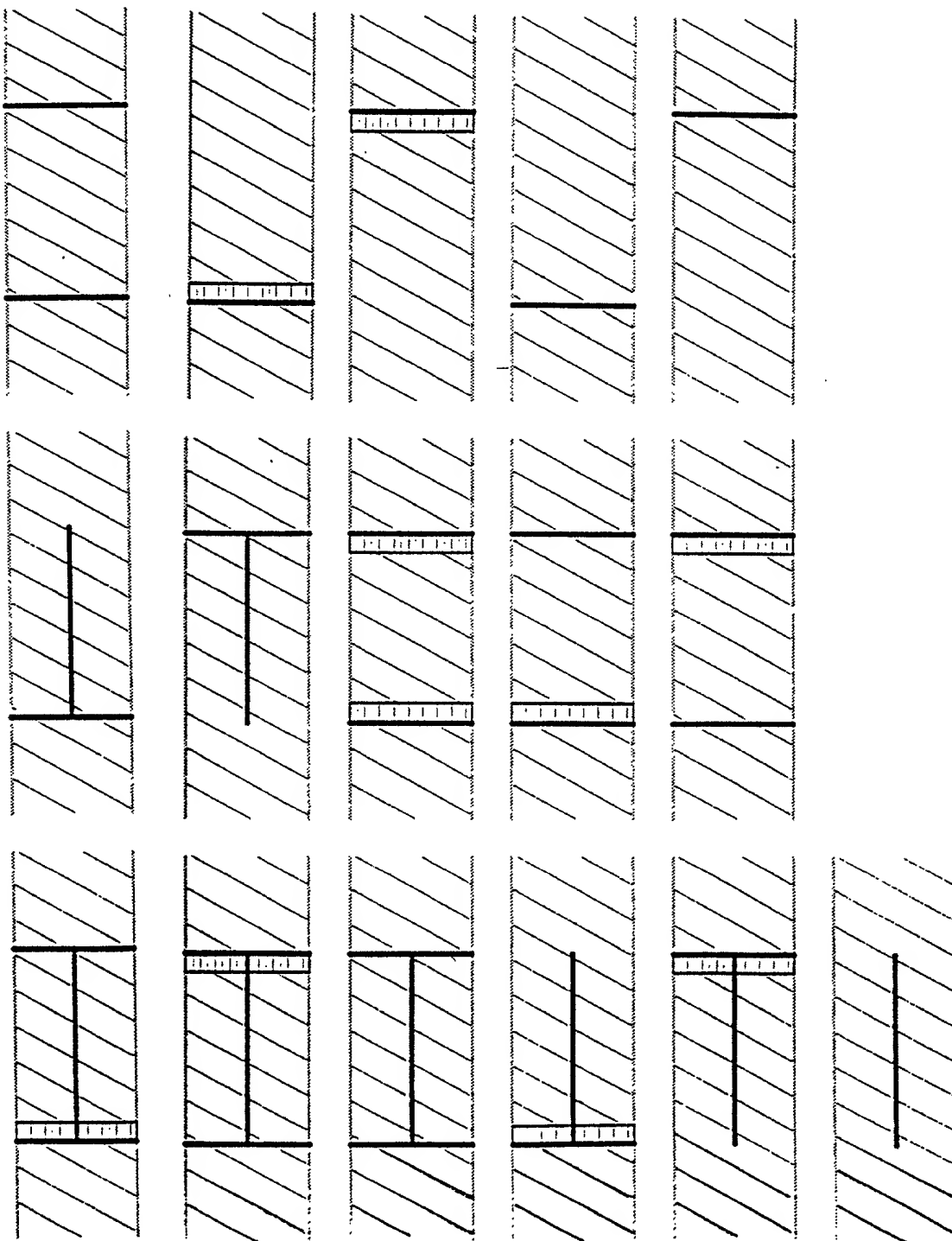


## Grundoperation:



Empfohlene Operationen:

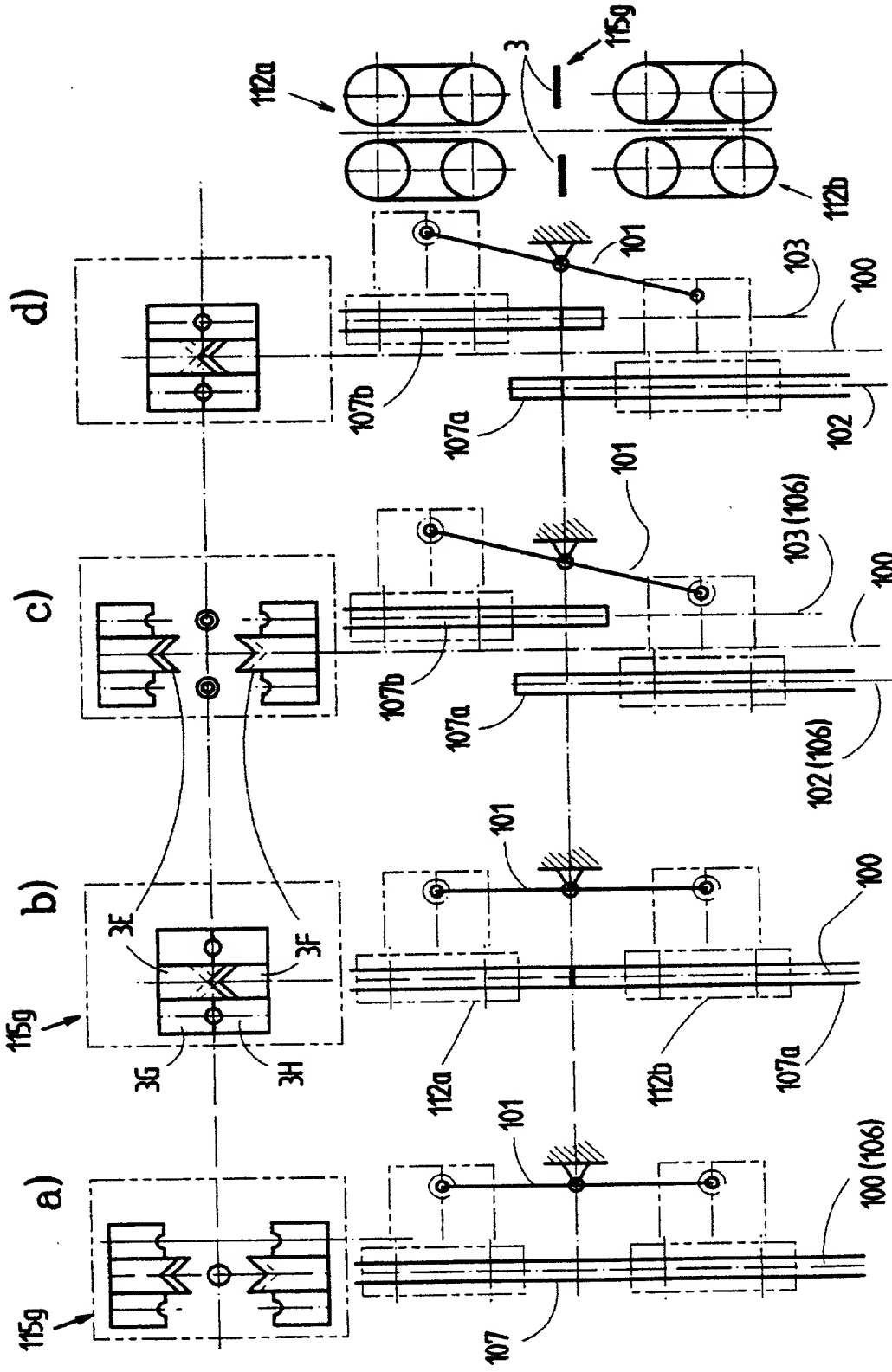
Fig. 20e 2/2





200002225000

Fig.23



28/33

Fig. 24

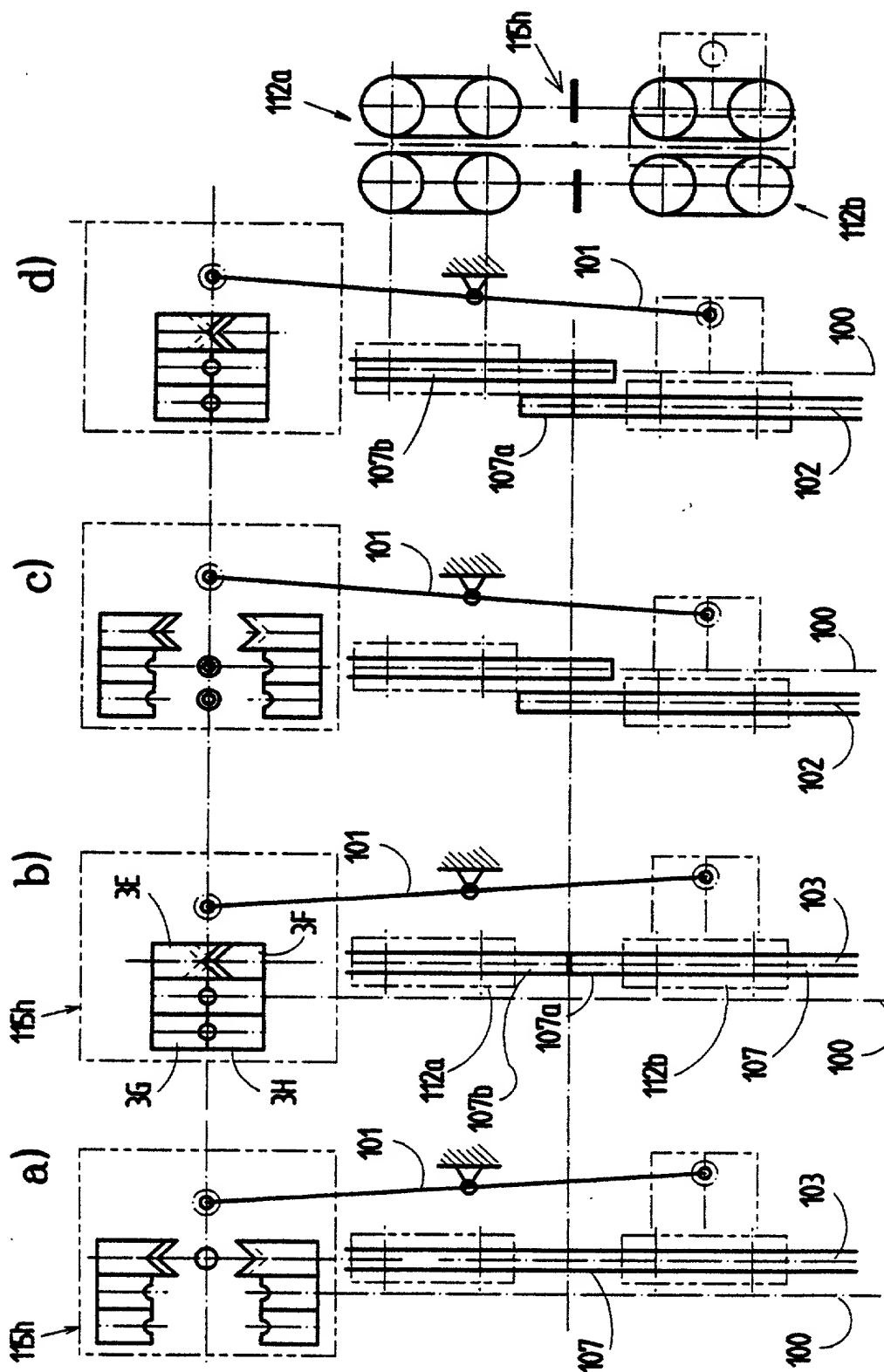


Fig. 26

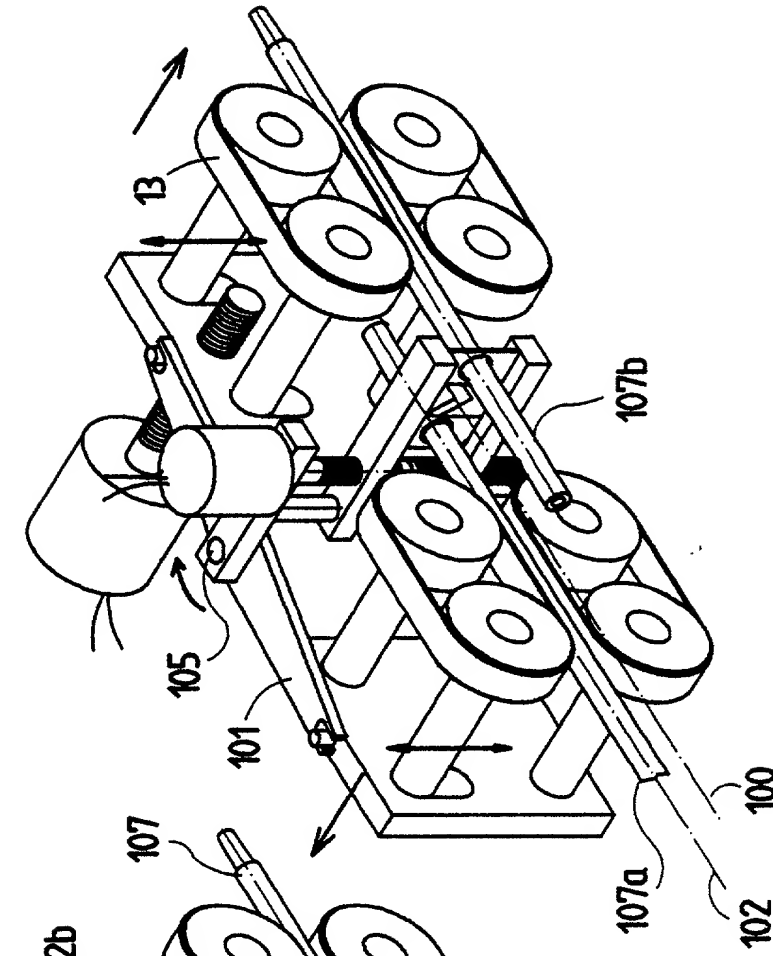


Fig. 25

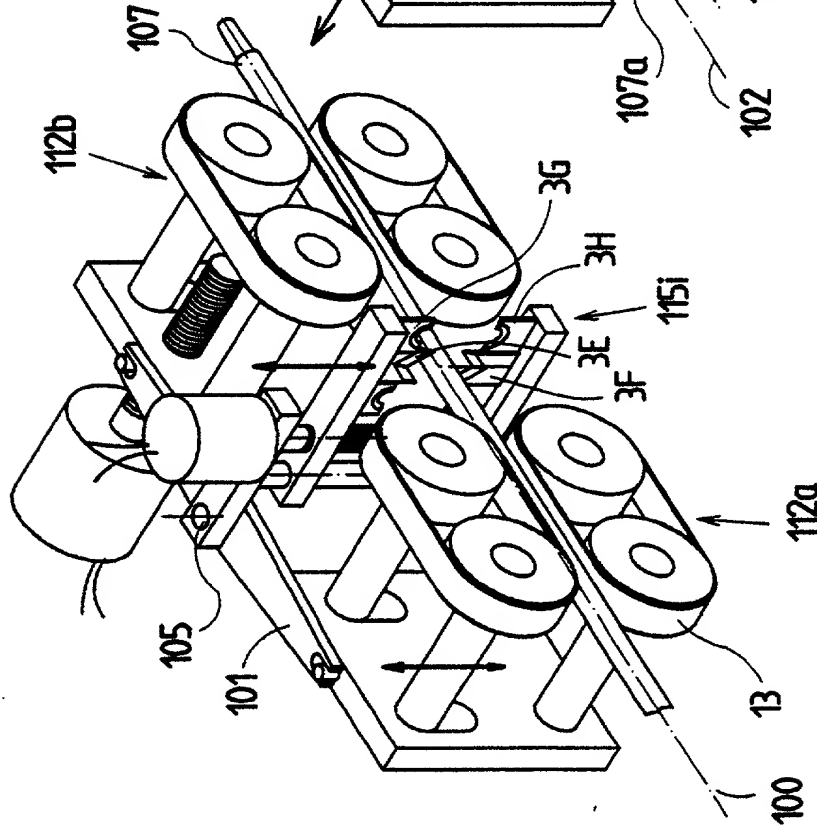


Fig. 27

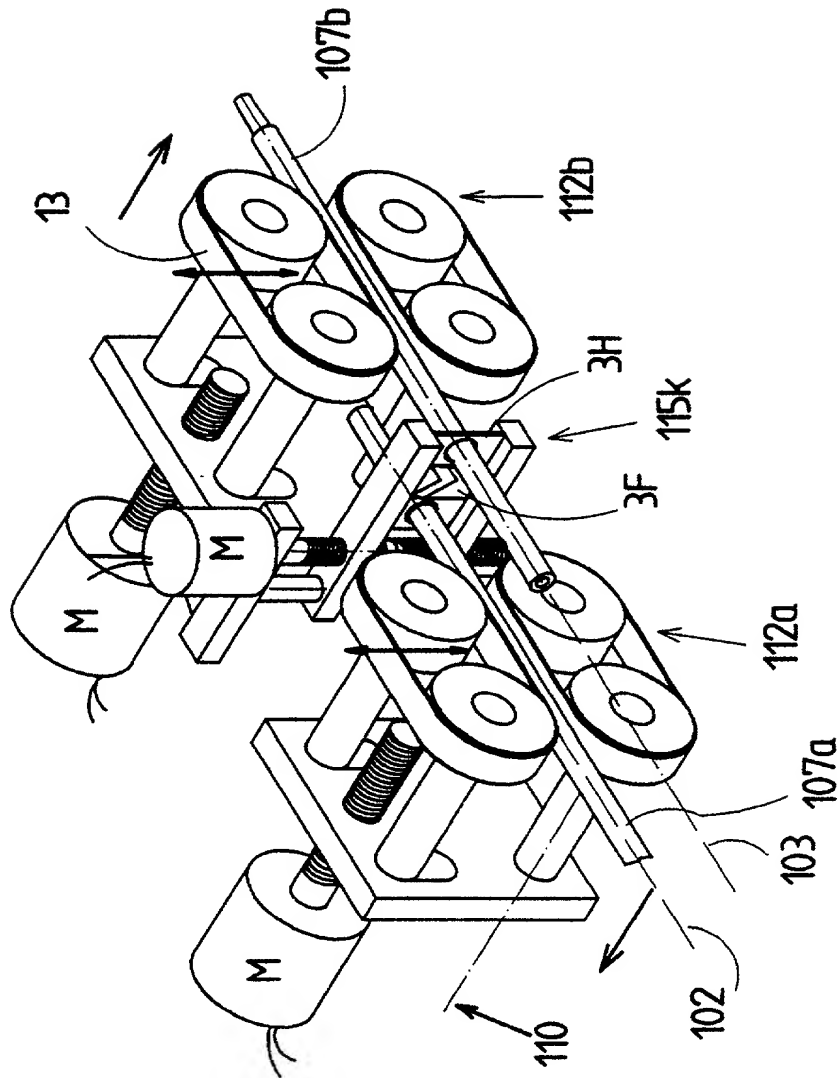


Fig. 28

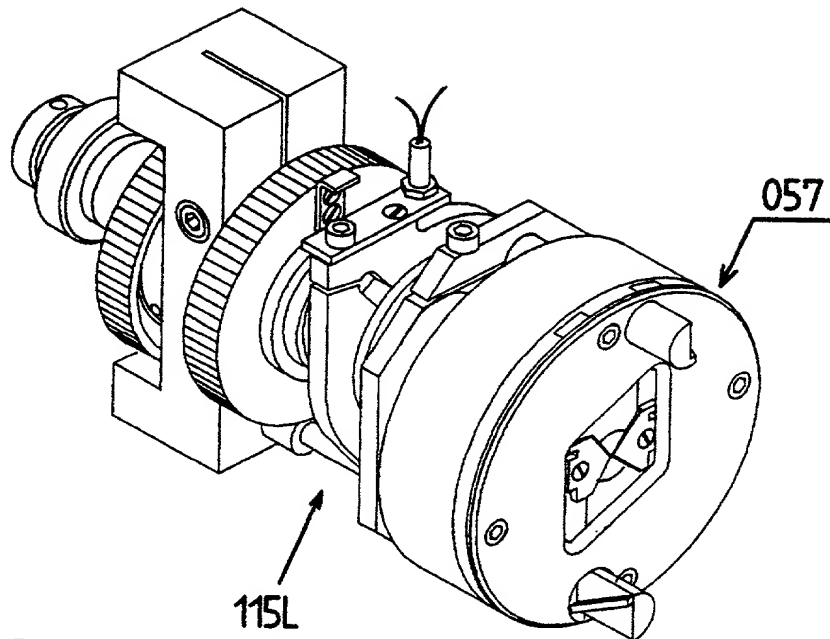


Fig. 29

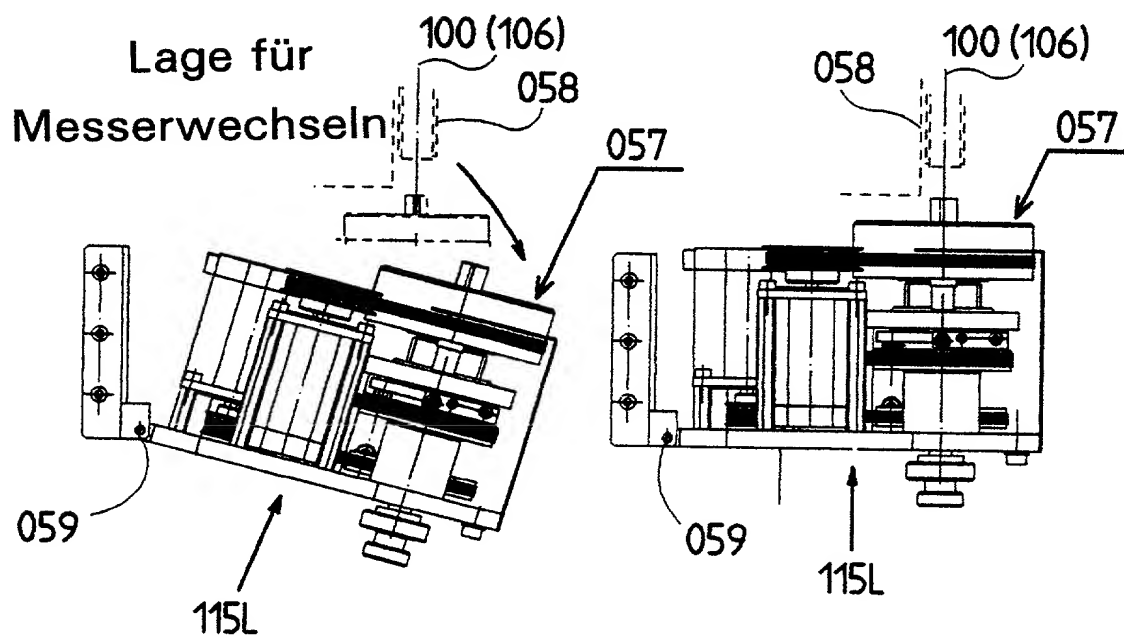


Fig. 30

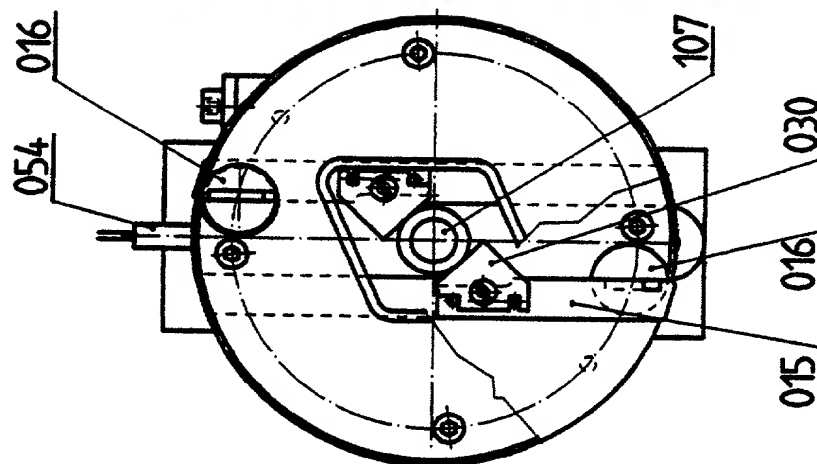


Fig. 31

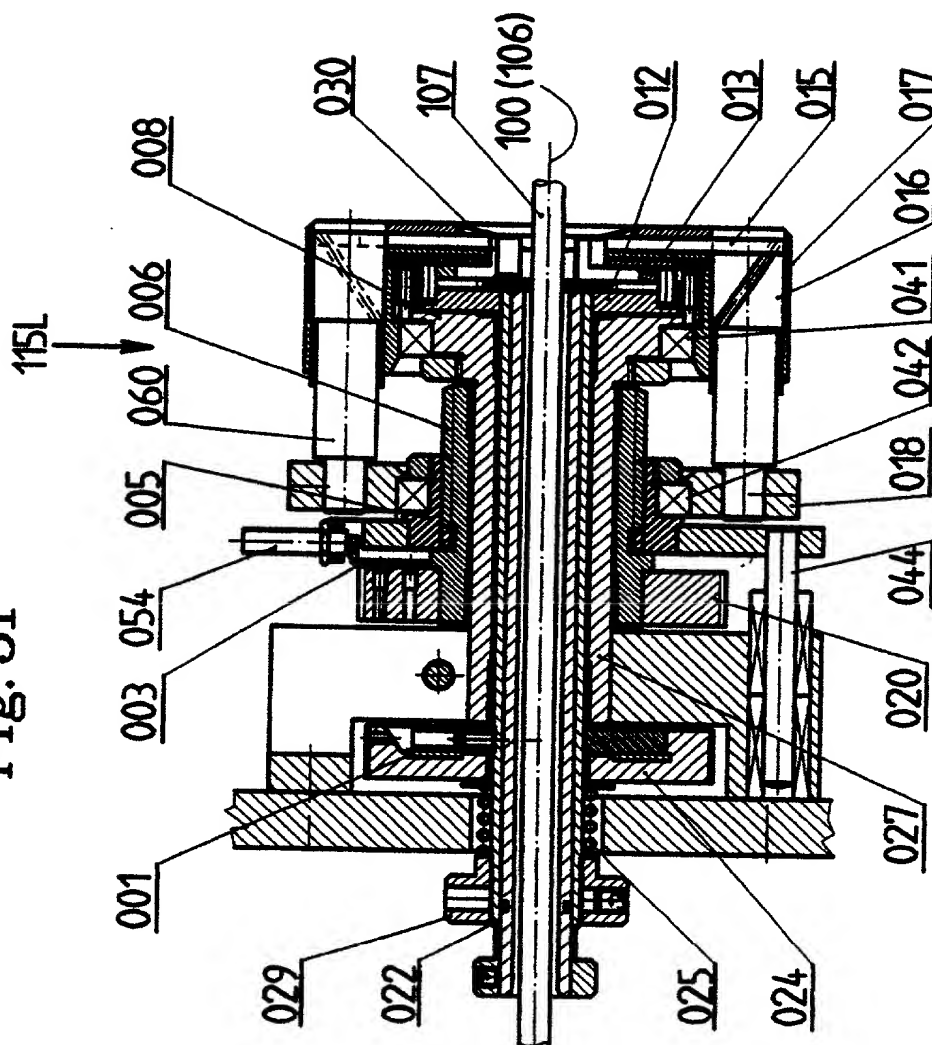


Fig. 21

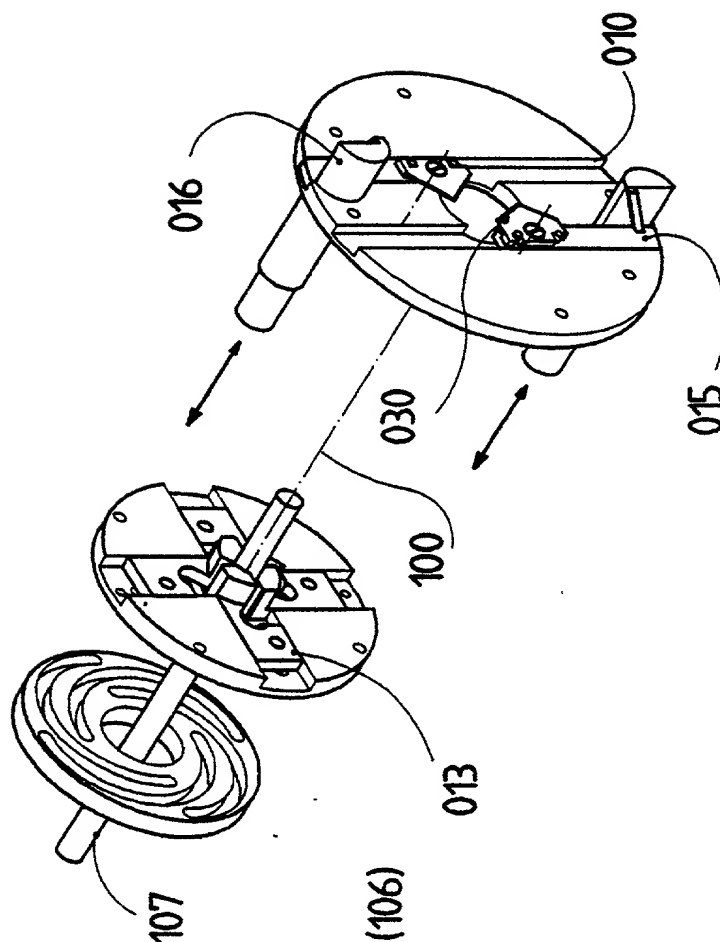
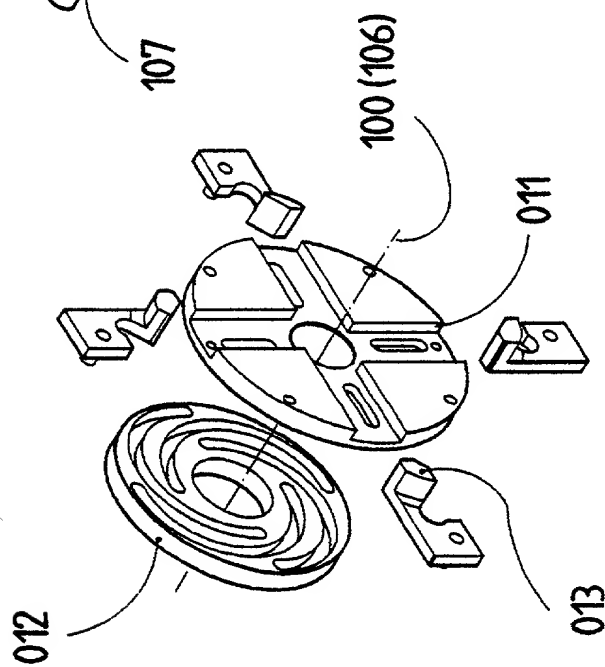


Fig. 32



Docket No.  
(ROS) S11-PC/PC1/US

# Declaration and Power of Attorney For Patent Application

## English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

**Continuous Cable Processing Device**

the specification of which

(check one)

☐ is attached hereto.

☒ was filed on May 5, 1998 as United States Application No. or PCT International  
Application Number 09/068,278  
and was amended on \_\_\_\_\_  
(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)		Priority	Not Claimed
<u>2329/96</u>	<u>Switzerland</u>	<u>23/09/1996</u>	<input type="checkbox"/>
(Number)	(Country)	(Day/Month/Year Filed)	
<u>                    </u>	<u>                    </u>	<u>                    </u>	<input type="checkbox"/>
(Number)	(Country)	(Day/Month/Year Filed)	
<u>                    </u>	<u>                    </u>	<u>                    </u>	<input type="checkbox"/>
(Number)	(Country)	(Day/Month/Year Filed)	

I hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional application(s) listed below:

\_\_\_\_\_  
(Application Serial No.)

\_\_\_\_\_  
(Filing Date)

\_\_\_\_\_  
(Application Serial No.)

\_\_\_\_\_  
(Filing Date)

\_\_\_\_\_  
(Application Serial No.)

\_\_\_\_\_  
(Filing Date)

I hereby claim the benefit under 35 U. S. C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C. F. R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

**PCT/EP97/05216**

**23 September 1997**

**Pending**

\_\_\_\_\_  
(Application Serial No.)

\_\_\_\_\_  
(Filing Date)

\_\_\_\_\_  
(Status)  
(patented, pending, abandoned)

\_\_\_\_\_  
(Application Serial No.)

\_\_\_\_\_  
(Filing Date)

\_\_\_\_\_  
(Status)  
(patented, pending, abandoned)

\_\_\_\_\_  
(Application Serial No.)

\_\_\_\_\_  
(Filing Date)

\_\_\_\_\_  
(Status)  
(patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

M. Robert Kestenbaum Reg. No. 20, 430

Send Correspondence to: M. Robert Kestenbaum  
11011 Bermuda Dunes NE  
Albuquerque, New Mexico 87111

Direct Telephone Calls to: (name and telephone number)  
M. Robert Kestenbaum (505) 323-0771 Fax (505) 323-0865

Full name of sole or first inventor	
<b>Beat Locher</b>	
Sole or first inventor's signature	Date
<i>B. Locher</i>	<i>2.6.1998</i>
Residence	
<b>Thun</b>	
Citizenship	
<b>Swiss</b>	
Post Office Address	
<b>Biergutstrasse 9</b>	
<b>CH-3608 Thun, Switzerland</b>	

Full name of second inventor, if any	
<b>Jiri Stephan</b>	
Second inventor's signature	Date
<i>J. Stephan</i>	<i>26. V. 1998</i>
Residence	
<b>Sargans</b>	
Citizenship	
<b>Swiss</b>	
Post Office Address	
<b>St. Gallerstrasse 76</b>	
<b>CH-7320 Sargans, Switzerland</b>	